2014 ANNUAL REPORT

Groundwater Monitoring and Whole House Filter Program
for Moses Lake Wellfield Superfund Site
(Former Larson Air Force Base)

Moses Lake, Washington

CERCLIS Site No. WAD988466355

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ACRONYMS

1,1-DCE	1,1-Dichloroethene
ADR	Automatic Data Review
AFB	Air Force Base
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
cis-DCE	cis-1,2-Dichloroethene
COC	Contaminant of concern
1,2-DCA	1,2-Dichloroethane
1,1-DCA	1,1-Dichloroethane
DERP-FUDS	Defense Environmental Restoration Program - Formerly Used Defense Sites
DQIs	Data Quality Indicators
DQOs	Data Quality Objectives
DoD QSM	Department of Defense Quality Systems Manual for Environmental Laboratories
DSHS	(Washington) Department of Social and Health Services
GAC	Granular Activated Carbon
IA	Interagency Agreement
IROD	Interim Record of Decision
MCL	Maximum Contaminant Level
MWH	Montgomery Watson Harza
NC	Not calculated
µg/L	Micrograms per liter
PDB	Passive diffusion bag
PE	Performance Evaluation
QC	Quality Control
QAPP	Quality Assurance Project Plan
QCSR	Quality Control Summary Report
RI	Remedial Investigation
RL	Reporting Limit
ROE	Right-of-Entry
SEDD	Staged Electronic Data Deliverable
TCE	Trichloroethene
trans-DCE	trans-1,2-Dichloroethene
1,1,1-TCA	1,1,1-Trichloroethane
USACE	United States Army Corps of Engineers
USEPA	United States Environmental Protection Agency
VC	Vinyl Chloride
VOC	Volatile Organic Compounds
WDOE	Washington (State) Department of Ecology
WDOH	Washington (State) Department of Health
WHF	Whole House Filter

EXECUTIVE SUMMARY

The purpose of this Annual Report is to summarize findings from the 2014 Moses Lake Wellfield Superfund Site (Site) sampling program completed by the U.S. Army Corps of Engineers (USACE) on behalf of the U.S. Environmental Protection Agency (EPA), Region 10, and pursuant to the 2008 Interim Record of Decision (IROD) for the Site (EPA 2008). The objectives of this sampling program are 1) to ensure protection of human health by sampling groundwater and comparing values to the Federal drinking water Maximum Contaminant Level (MCL) for Site contaminants such as trichloroethene (TCE), and 2) to gather baseline data prior to implementation of pump and treat systems. As part of the sampling program, USACE also installs and maintains Whole House Filter (WHF) treatment systems at private properties to prevent human exposure to TCE and related contaminants of concern (COCs) at levels that exceed their MCLs.

The 2014 sampling program consisted of four events:

- Event 1 (November 2013);
- Event 2 (February 2014);
- Event 3 (May/June 2014); and
- Event 4 (September/October 2014).

Monitoring and extraction well results for the 2014 sampling year indicated exceedances of the TCE MCL in approximately 36% of the wells. There were no exceedances of TCE or cis-1, 2-dichloroethene (cis-DCE) MCLs in the private wells.

USACE sampled approximately 70 private wells and 71 monitoring wells over the course of the year, and also replaced granular activated carbon (GAC) annually for the private wells with WHFs. There are currently nine homes with WHFs. There have been no detections of TCE or cis-DCE in the effluent samples (i.e., leading into the homes), which confirmed that the WHFs are protecting human health.

An action threshold of 2 µg/L TCE has been used to place private wells (those used for drinking water, etc.,) on quarterly sampling (as opposed to annual sampling), and an action threshold of 3.5 µg/L TCE has been used to determine which drinking water wells would receive a WHF. The 3.5 µg/L value accounts for analytical uncertainty of the method used for TCE quantitation to ensure human exposure above the MCL does not occur. Results from quarterly sampling identified one private residential well (WP-123) with TCE concentrations that exceeded the TCE action threshold of 3.5 µg/L. Based on these findings, USACE coordinated with EPA and residents and installed a WHF on private well WP-123 in September 2014.

Recommendations from the 2014 sampling program are provided below.

Groundwater Monitoring Wells

- Evaluate historical groundwater elevation data and TCE concentrations for evidence of seasonal fluctuations to ensure conservative timing of future optimized annual sampling events in the groundwater monitoring program.

- Evaluate recent groundwater elevation data collected in support of the 2017 south plume pump and treat system startup in parallel with historic groundwater information to ensure sufficient baseline data are available to support pump and treat system optimization analysis following start-up of the south plume pump and treat system.

- There are currently only two monitoring wells located in Cascade Valley. The monitoring well pair is located just south of Dick Road, which is approximately one mile south of the main plume. Installation of additional monitoring wells in the northern part of Cascade Valley is recommended to refine the conceptual site model and determine the source of the TCE impacting the private wells.

- Installation of monitoring wells in the Roza 1 basalt aquifer upgradient of Cascade Valley (generally upgradient of WP-04) and downgradient of 04BW06 is recommended to better define the origin of contaminant concentrations in the private wells of Cascade Valley. Presently, it is unclear whether contamination impacting the N. Cascade Valley is coming from the distal portion of the Main Plume, or another unidentified TCE source. In addition, a review of private well boring logs is recommended to determine those well completion elevations so that those elevations can be used to determine where to install new monitoring wells.

- Enter monitoring well boring logs and WDOE driller logs (when deemed suitable for interpretation) into a geologic database so that subsurface cross-sections can be readily generated through the main and south plumes and into Cascade Valley.

Private Wells

- Continue collecting annual groundwater samples from all private wells with any historic COC detections on an annual basis to document plume migration.

- Continue updating the sampling program by adding new private wells, small public water systems (and monitoring wells) with high likelihood of COC detections as they are identified through Department of Ecology's well log database.

- For private wells that exceed 2.0 µg/L TCE, continue collecting quarterly groundwater samples for at least four quarters to evaluate patterns in seasonal and temporal system variability that support future sampling frequency and timing recommendations.

- Continue to communicate with residents who have not agreed to groundwater monitoring but are located in areas anticipated to have elevated TCE concentrations. Document that the residents have declined to participate in the monitoring program and that the Government has informed residents of the risks associated with exposure to water exceeding the MCL for TCE.

- Conduct a comprehensive review of WDOE drillers' logs versus assigned private well numbers (WP series) and evaluate whether WDOE logs are suitable for interpretation in a geologic database.

Whole House Filter Systems

- Continue to install and maintain WHF systems at private wells that exceed the action threshold of 3.5 µg/L TCE.

- Continue to monitor the efficiency of WHF systems by tracking if TCE exceeds its action level of 3.5 µg/L at the mid or effluent ports, and take steps to correct any issues.

- Use information from the WHF totalizing flow meters, which measure the volume of water treated by the WHF systems, to monitor and evaluate the efficiency of the treatment systems.

- Over time, if concentrations at the influent ports to WHFs decline, work with EPA to determine which WHFs can be removed from residential wells.

1. INTRODUCTION

Under an Interagency Agreement (IA) with U.S. Environmental Protection Agency (EPA), Region 10, the Seattle District U.S. Army Corps of Engineers (USACE) provides ongoing technical assistance focused on groundwater sampling and Whole House Filter (WHF) maintenance as required to protect human health at the Moses Lake Superfund Site (Site). The purpose of this Annual Report is to summarize findings from the 2014 annual sampling program completed by USACE on behalf of EPA to support requirements within the Interim Record of Decision (IROD; EPA 2008) for the Moses Lake Superfund Site (Site). This report is organized as follows:

- Section 1: Introduction
- Section 2: Sampling and Field Activities for 2014
- Section 3: Analysis, Data Validation, and Results
- Section 4: State Well Inventory Database Search
- Section 5: Summary and Discussion
- Section 6: Recommendations

1.1. 2014 Sampling Program Scope of Work

The scope of work for the USACE 2014 sampling program included the following:

- Obtaining and updating Rights of Entry (ROEs) for site access;
- Installation, replacement, and maintenance of whole house filter (WHF) systems;
- Collection, analysis, and evaluation of contaminant of concern (COC) data and groundwater elevation data in groundwater monitoring wells;
- Collection, analysis, and evaluation of COC data in untreated private wells and private wells with WHF systems;
- Coordination and contracting with laboratories and subcontractors for data analysis and data validation.
- Updating the project database (EQuIS™) with sampling results; updating an Excel spreadsheet with sampling results.
- Review of the Washington State Department of Ecology (WDOE) Well Inventory Database for newly constructed private wells that may be at risk for COCs;
- Preparation of a Work Plan-Quality Assurance Project Plan for the 2014 work, and an Annual report summarizing activities, analytical results, and recommendations (this document); and

- Notification of residents of annual sampling results.

1.2. Site Background

The Site is located within and beyond the northwestern region of the City of Moses Lake, Washington (see Figure 1 for Site location and Figure 2 for contaminant boundaries at time of IROD). The Site encompasses approximately 15 square miles and includes the Grant County International Airport and surrounding area (formerly the Larson Air Force Base (LAFB)), commercial facilities, and residences.

Previous environmental investigations conducted at the Site identified contamination of soil and groundwater resulting from historic operation of the former LAFB and industrial activities associated with the aircraft industry. Potential source areas are scattered throughout the Site and approximately 1000 acres of groundwater have been identified as contaminated to date.

Previous investigations focused primarily on the former LAFB. The former LAFB occupied approximately 9607 acres and was active from 1942 until 1966. In 1988, three municipal wells operated by the City of Moses Lake were found to be contaminated with trichloroethene (TCE). Additionally, TCE was historically detected in two domestic wells operated by the Skyline Water System, Inc., a private water provider located in unincorporated Grant County south of the former LAFB property. Domestic (residential) and commercial (light or heavy industrial) private wells locations outside the former base have also had detections of TCE. TCE concentrations associated with the Site have been found to exceed EPA's National Primary Drinking Water Standards (the Maximum Contaminant Level (MCL)) under the Federal Safe Drinking Water Act. The MCL represents the maximum level (i.e., concentration) of the contaminant allowed in drinking water, and is set at 5 micrograms per liter (μg/L) for TCE.

Based on the TCE detections described above, between 1989 and 1993 the City chose to fix the three contaminated City water-supply wells south of the Airport by extending the casings down to the lower basalt aquifers. In addition, the Skyline community, which was dependent on the contaminated Skyline water system, received an alternative water source (bottled water) between 1997 and 2003. In 2003, USACE completed construction of a replacement water-supply well, which draws water from a deeper, uncontaminated groundwater aquifer, and currently provides drinking water to the Skyline community.

Following findings of contaminated domestic (private) wells and upon request from Region 10 EPA, USACE began a private well groundwater sampling program in 2001. The groundwater sampling program has been used to ensure that humans are not exposed to contaminant concentrations above the MCL, and to monitor TCE plume migration. Under this program, drinking water from private wells[1], small drinking water systems (Group A and B systems)[2] were sampled (with some gaps between sampling events) for TCE related compounds. Recently, USACE added monitoring well sampling to the annual event, and those data are presented with the results from private wells and small drinking water systems in one annual report.

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1 Private wells consist of wells used for drinking and other domestic uses, and industrial process wells.

2 Group A systems are defined in RCW 70.119A.020 as a public water system providing water to at least 15 service connections, 25 people per day for at least 60 days per year, or 1,000 or more people on two consecutive days. Group B water systems serve fewer than 15 service connections and fewer than 25 people per day, OR 25 or more people per day for fewer than 60 days per year provided the system doesn't serve 1,000 or more people for two consecutive days (WAC 246-291-005).

City of Moses Lake wells are routinely sampled for VOCs per WA State Dept. of Health (WDOH) requirements, and the results are posted on WDOH's website. However, since the wells that WDOH samples are all screened below the contaminated aquifers, those data are not included in this report.

For ease of reporting, small drinking water systems are reported as part of private wells. The majority of private wells sampled are located in the Cascade Valley area immediately downgradient of the main (north) and south plumes (see Figure 4 through Figure 12). In 2002, following two private well monitoring events, a whole house filter (WHF) system was designed and installed at five residential sites where it was determined that TCE contamination could potentially exceed the drinking water standard for TCE (5 µg/L).

Groundwater monitoring wells have been installed over the last 22 years in order to monitor the Site. Groundwater elevation data are collected where available to evaluate groundwater flow direction and are also used to evaluate plume migration at groundwater monitoring wells.

An IROD was signed in September 2008 (EPA 2008) for cleanup actions in areas with soil and groundwater contamination that exceed risk-based concentrations. The IROD required groundwater pump and treat systems to be installed for two of five identified TCE plumes. The IROD further specified that cleanup levels will be attained throughout all the plumes, but active remediation may be discontinued if it can be demonstrated that natural attenuation (through dilution) can remediate the remnant plumes in a reasonable timeframe (within the estimated 30 years for cleanup).

The IROD specifies that information gathered during groundwater monitoring, as well as design and operation of the selected groundwater pump and treat system, be used to determine the need for refinement of the selected groundwater remedy to meet groundwater restoration goals. Currently, EPA is designing a pump and treat system for the south plume that is anticipated to be operational in spring of 2017 (the south plume as defined in the IROD is illustrated in Figure 2). Information from operation of the south plume treatment system will be used to make decisions on a second pump and treat system that is planned to be installed for the main plume.

The COCs monitored in the groundwater sampling program are as follows:

- trichloroethene (TCE)
- cis-1,2-dichloroethene (cis-DCE)
- trans-1,2-dichloroethene (trans-DCE)
- vinyl chloride (VC)
- 1,1-dichloroethene (1,1-DCE)
- 1,2-dichloroethane (DCA)
- 1,1,1-trichloroethane (TCA)
- 1,1-dichloroethane (1,1-DCA)

However, only TCE has a cleanup level established in the IROD, and the other VOCs have either never been detected or have been detected only at levels far below any established MCL or risk-based cleanup level.

1.3. Geologic Setting

The Site occupies a nearly flat fluvial terrace bounded to the east by Crab Creek and to the south and west by Moses Lake. The geologic units affected by contamination include, with increasing depth and from youngest to oldest: sand and coarse gravel deposited by huge glacial floods (Hanford formation), silt and sand deposited in lakes and rivers (Ringold Formation, locally eroded away to the north and east), and several extensive basalt flows of the Wanapum Basalt Formation. The Wanapum Basalt at the Site is divided into three members as follows, from geologically youngest to oldest: the Priest Rapids Member, the Roza Member, and the Frenchman Springs Member. At the Site, the Roza Member consists of three basalt flows, of which Roza 1 is the youngest and always the first encountered. The Priest Rapids Member overlies the Roza Member in the central portions of the Site, but is mostly highly weathered and has been eroded away entirely along the east and west margins. The basalt flows typically have a vesiculated, fractured, and sometimes brecciated flowtop overlying a dense flow interior characterized by vertical cooling fractures. The deeper and less weathered the basalt flows are, the more likely these fractures are to be completely filled by secondary minerals (EPA 2008).

Figure 3 illustrates the Hydrogeologic Conceptual Model, which shows the geological members as defined in the IROD. The hydrostratigraphic units relevant to the Site are as follows:

- Hanford Formation (aquifer in areas, but unsaturated beneath a substantial portion of the Site)
- Ringold Formation (locally semi-confining, locally water-bearing, absent in areas
- Priest Rapids and flow-top of Roza 1 (aquifer)
- Dense flow interior of Roza 1
- Roza 2 flow top (aquifer) Dense flow interior of Roza 2 (aquitard)

TCE has been detected in all three aquifers described above, indicating that there is some connectivity between aquifers. The highest concentrations of TCE are found in the Priest Rapids and flow-top of Roza 1 aquifer. The TCE occurrence and migration pathways are also illustrated on Figure 3, showing the complexity of contaminant flow through the fractured basalts.

Monitoring well nomenclature is based on the Hydrogeologic Conceptual Model. The Hanford Formation aquifer is generally associated with the “AW” series monitoring wells; the Priest Rapids and Roza 1 aquifer is associated with “BW” series monitoring wells; and the Roza 2 basalt flow is associated with the “CW” series monitoring wells. An example of monitoring well nomenclature is 12BW05, which represents a well drilled in 2012 (12), screened within the Priest Rapids and Roza 1 aquifer (BW), and fifth in the BW monitoring well installation series (05) for that year.

Contamination is primarily located in the upper basalt aquifers (Priest Rapids and Roza 1, and Roza 2). Some of the private wells may be drawing water from the overlying alluvium, but drill logs suggest that the majority of the private wells are open only in basalt. Some draw from several basalt flows, but rarely from below Roza 2.

1.4. Previous Investigations

On February 16, 1988, groundwater samples were collected by the Washington Department of Social and Health Services (DSHS) from eight wells serving the City of Moses Lake municipal water supply system. Analytical results indicated that three wells contained elevated concentrations of TCE. Additional sampling by DSHS in both September and December of 1988 found TCE in several City of Moses Lake and Skyline Water Company wells.

Based on these preliminary sampling results, EPA requested that Ecology and Environment, Inc. (E&E) outline possible approaches to identify the potential source or sources of TCE groundwater contamination in the Moses Lake area. E&E identified a number of potential source areas for the TCE contamination. In response to the detection of TCE in the municipal wells, USACE, the Department of Defense representative for deactivated armed forces bases, conducted interviews with former LAFB employees in 1989. These interviews identified four potential chemical waste disposal areas and thirteen other potential areas where TCE may have been handled, as source areas for groundwater contamination. Additional relevant investigations and actions since 1989 have been as follows:

- October 14, 1992 – Site listed on the National Priority List (NPL).

- 1993 – Dames & Moore completed a Phase I Remedial Investigation (RI) Report, documenting TCE in the Hanford Formation and Priest Rapids-Roza 1 aquifer. The investigation did not include the lower basalt (Roza 2) aquifer. The boundary of the TCE plume was partially defined to the north and east, but the south and west were not clearly delineated.

- 1995 - Dames & Moore completed an addendum to the 1993 Phase I RI, confirming TCE in the central and southern portion of the former LAFB in the Hanford Formation and upper Priest Rapids-Roza1 groundwater.

- 1998 - URS Greiner sampled private water wells and other wells for Class A and Class B water systems east, south, and southwest of the previously known TCE plume. There were eight detections of TCE during this study.

- 1999 - USACE retained Montgomery Watson to perform an RI at the Site. During the course of the RI, several private wells were tested and found to be contaminated with TCE. Four wells that were previously outside of the TCE plume were found to be above the detection limit (MWH 1999).

- 2001 - USACE contracted with MSC Environmental to install single stage WHF carbon filtration units at five of the wells.

- 2003 – USACE completed a replacement well for the Skyline Water Supply system to replace the two contaminated original Skyline wells. During construction of the replacement well, TCE contamination was unexpectedly found in the Roza 2 aquifer, so drilling continued to the Frenchmen Spring Member basalt aquifer, and the well was screened at 661 to 722 ft bgs.

- 2004 - USACE confirmed TCE contamination in the Roza 2 aquifer as part of the Nature and Extent Investigation completed to support the FS.

- 2007 - CALIBRE began replacing the original single filter units with lead-lag systems. In June 2008, filters were replaced at private wells known as WP-14, WP-70, WP-82, WP-83, and WP-86.

- 2009-2012, four rounds of monitoring and filter replacement occurred at WP-14, WP-82, WP-83, and WP-86 (EHS 2009a; EHS 2009b).

- Since 2012, field work has been performed by USACE staff, analytical work by Analytical Resources, Inc (ARI), and data validation by Laboratory Data Consultants, Inc (LDC). Since 2013, WHF work has been done by McMullen Water Systems.

1.5. USACE Investigation Strategy

The USACE investigation strategy, with input from EPA, includes sampling groundwater monitoring wells and private wells to ensure protection of human health by comparing the results to the federal drinking water MCL for Site contaminants such as TCE that resulted from historic Site activities. The investigation strategy for monitoring wells and private wells is provided below, and is based on the USACE Work Plan-QAPP developed or adjusted each year for the sampling program.

1.5.1. Groundwater Monitoring Wells and Extraction Wells

Between 1991 and 2005, approximately 82 groundwater monitoring wells were installed on the Site by licensed drillers contracted by USACE. An additional 21 monitoring wells have been installed since that time for a total of approximately 103 monitoring wells installed across the site within multiple aquifers. Of those 103 monitoring wells, at least 40 wells are known to have been fitted with dedicated bladder pumps, and 35 others had never had dedicated sampling pumps installed and were designated for passive diffusion bag (PDB) sampling when USACE resumed Site groundwater monitoring in 2013. EPA and USACE agreed to implement PDB sample collection at the remaining 35 monitoring wells based on cost effectiveness, close correlation between PDB sampler and bladder pump sampling results at most wells evaluated during the Nature and Extent Investigation (NEI) conducted by USACE in 2004-2005, and PDB case studies and investigations conducted by the US Geological Survey and the US Air Force.

Groundwater monitoring well sampling has been focused on identifying plume concentrations and extent, and included collection of groundwater elevation data to evaluate groundwater flow direction and plume migration. Samples were obtained from dedicated bladder pumps installed in monitoring wells or from passive diffusion bags (PDBs). The majority of the monitoring wells are located northeast of the Cascade Valley area (see Figure 4).

Groundwater analytical data will be used to assess plume migration both before and after the groundwater pump and treat system is operational, and will support groundwater contour modeling. Monitoring data will be used to assess the effectiveness of the future groundwater pump and treat system in restoring groundwater to Federal drinking water standards and State cleanup levels.

Five extraction wells (12EX01, 12EX02, 14EX03, 14EX04 and 14EX05) have been installed in the Roza 1 aquifer as part of a future pump and treat remedy for the south plume. The treatment system is anticipated to be operational in 2017. The extraction wells to date have been treated like monitoring wells, and have been sampled using PDBs following the same procedures as the monitoring wells.

1.5.2. Private Wells

The Moses Lake IROD requires preventing human exposure to COCs in groundwater that are above their MCLs. TCE is the focus for interim groundwater monitoring activities, since it is the only COC that historically has exceeded its MCL (5 µg/L). In fact, it is the only groundwater COC listed in the IROD. The investigation strategy for the private well sampling program historically began with a list of existing private wells within the 5 µg/L TCE plume boundary or near the leading edge of the plume boundary. Some well owners were recruited for the private groundwater sampling program in the 1990s and early 2000s. Other residents have asked to be included in the sampling program over the years. USACE successfully recruited many additional home owners in 2012/2013, and the private well network was also optimized in 2013 to remove a number of non-detect wells that were outside of the plume area. As more information has become available that helps identify private wells that may be impacted, well owners have been and will continue to be recruited for evaluation.

Sampling of private wells prior to 2013 consisted of selecting up to 53 private (domestic) wells per year to assess TCE concentrations within the Site. The majority of private wells sampled are located in the Cascade Valley area immediately downgradient of the main and south plumes (see Figure 5). Information regarding private well depth and screen length is typically limited, but can be available in WDOE installation records or based on the well owner's personal knowledge. It is believed that groundwater collected from private wells in the Moses Lake area is primarily from the upper basalt aquifers (Roza 1 and Roza 2). While information on groundwater monitoring wells is more complete in the Moses Lake area overall, there are only two groundwater monitoring wells located within the Cascade Valley and none immediately upgradient. Therefore, it is unclear whether the TCE contamination detected in private wells originates from the main plume to the northeast, the south plume to the east, or from an unidentified source to the north of Cascade Valley. Addressing this data gap is critical for refining the CSM.

Historically, a Site action threshold of 3.5 µg/L of TCE has been used as the groundwater concentration at which cautionary engineering controls such as WHFs are implemented. The action threshold accounts for analytical uncertainty of the method used for TCE quantitation to ensure human exposure above the MCL does not occur. This value is based on the analytical laboratory lower recovery limit of 30 percent, applied to the TCE MCL of 5 µg/L (5.0 µg/L – [0.30% *5] = 3.5 µg/L). Wells with existing WHFs are sampled initially quarterly (influent, mid, and effluent ports) to determine contaminant loading to the activated carbon filters for calculation of potential contaminant breakthrough (i.e., concentrations that exceed the action threshold). After a year of sampling, a WHF efficiency analysis is performed to verify that the WHF filters are preventing exposure to TCE, and to determine if sampling frequency can be reduced.

The 2014 (and continuing) sampling strategy for private wells is to sample annually the entire suite of wells, and quarterly those with either WHFs or TCE detections that have historically been greater than 2.0 µg/L. Groundwater elevation data are not obtained from the private wells due to the potential for entangling the water level indicator cable with pump plumbing and/or cables present in the private wells. Additionally, many of the well heads are not equipped with sounding ports. Consequently, well head elevations have not been surveyed.

2. SAMPLING AND FIELD ACTIVITIES FOR 2014

The 2014 sampling program consisted of four events described below. A detailed report for each sampling event can be found in Appendix A (Groundwater Sampling Field Reports). Table 1 lists the wells that were sampled for each event, and Appendix B includes comprehensive analytical results for all 2014 events.
A summary of each sampling event is provided below for groundwater monitoring wells and private wells. USACE only sampled properties where the well is located and for which we had Rights-of-Entry (ROEs). For homes without wells that were supplied by neighboring wells, no sampling was generally conducted on those properties; however, in many cases ROEs were obtained to facilitate sending sampling results.

At wells with WHF systems, samples were collected before and after GAC replacement upstream of the filtration system (the influent sample), between the lead and lag filter units (the mid sample), and downstream of the lag filter unit (the effluent sample, which is the post-filtration sample prior to water entering the residence). WHF systems were inspected every six months to ensure all parts were working properly and to replace the fines filters; both GAC vessels of each system were replaced annually.

A snapshot of which wells have WHFs and when they were installed or replaced is provided below:

WELL ID	Date WHF Installed/Replaced	Comment
WP-14	May 2013	Replaced WHF from mid-2000s
WP-70	May 2013	Replaced WHF from mid-2000s
WP-82	Removed	Was installed in early 2000s though no detections exceeded action threshold; was removed in 2013 because results continued to be less than action threshold.
WP-83	May 2013	Replaced WHF from mid-2000s
WP-86	May 2013	Replaced WHF from mid-2000s
WP-119	Aug 2013	Newly installed
WP-121	Aug 2013	Newly installed
WP-129	Sep 2013	Newly installed
WP-124	Oct 2013	Newly installed
WP-123	Sep 2014	Newly installed

Private wells without WHF systems were sampled from a water tap as close to the well head as possible.

2.1. Event 1 (November 2013)

2.1.1. Groundwater Monitoring Wells

During Event 1, no groundwater monitoring wells were sampled. In addition, no groundwater elevations were collected.

2.1.2. Private Wells

During Event 1, eight private wells with whole house filters were sampled as described below. All eight of the WHF wells (WP-14, WP-70, WP-83, WP-86, WP-119, WP-121, WP-124, and WP-129) were sampled from the influent, mid, and effluent sampling ports to document the presence of TCE in the influent port and efficiency of the filters based on the results from the effluent port. Before sample collection, totalizing flow meter readings were recorded. This meter reading will be recorded during all future quarterly events to provide data on water volumes passing through each filter system over time.

Six other private wells (WP-123, WP-125, WP-131, WP-167, WP-168, and WP-27) were sampled in November 2013. These wells were sampled because TCE concentrations between 2 and 3.5 µg/L were detected at those locations during the June 2013 sampling event. Data collected from these wells will be used for seasonal trend analysis.

2.2. Event 2 (February 2014)

2.2.1. Groundwater Monitoring Wells

During Event 2, no groundwater monitoring wells were sampled. In addition, no groundwater elevations were collected.

2.2.2. Private Wells

During Event 2, eight private wells with whole house filters were sampled as described below. All eight of the WHF wells (WP-14, WP-70, WP-83, WP-86, WP-119, WP-121, WP-124, and WP-129) were sampled from the influent, mid, and effluent sampling ports to document the presence of TCE in the influent port and efficiency of the filters based on the results from the effluent port. Before sample collection, totalizing flow meter readings were recorded.

Six other private wells (WP-123, WP-125, WP-131, WP-167, WP-168, and WP-27) were sampled in Event 2. These wells were sampled because TCE concentrations between 2 and 3.5 µg/L were detected at those locations during the June 2013 sampling event. Data collected from these wells will be used for seasonal trend analysis.

2.3. Event 3 (May/June 2014)

2.3.1. Groundwater Monitoring Wells

During Event 3, 71 groundwater monitoring wells were sampled in accordance with the project Work Plan-QAPP and Field Sampling SOPs (Attachments 3, 4, and 14 of the 2014 USACE Work Plan-QAPP), consisting of 36 bladder pump wells and 35 PDB wells. Groundwater elevation data were collected from all sampled monitoring wells (with and without bladder pumps) in May 2014 during the WHF pre/post change-out sampling. After water levels were measured, PDBs were installed in wells without dedicated bladder pumps. All wells were then sampled for VOCs in June 2014.

2.3.2. Private Wells

In May 2014, filters (i.e., the GAC vessels) were replaced at WHFs WP-14, WP-70, WP-83 and WP-86. Before sample collection, totalizing flow meter readings were recorded. The influent, mid, and effluent ports were sampled prior to the filter change-out. After the filters were replaced, the mid and effluent ports were sampled to ensure the filter systems were working properly. All systems were verified to be reducing effluent concentrations to below the TCE action threshold.

In June 2014, 68 private wells were sampled. Based on Event 3 results, a WHF was recommended for private well WP-123 and installed in September 2014. WP-04 was also recommended for quarterly sampling to support data collection for trend analyses, since TCE concentrations have been 4.8 µg/L or greater since June of 2014.

After sampling results from Event 3 were finalized, a WHF efficiency memorandum (memo) was prepared for WHF systems installed at WP-14, WP-70, WP-83 and WP-86 and submitted to EPA in the fall of 2014. The analysis was based on four sampling events (August 2013, November, 2013, February 2014, and May 2014). See Section 3.4.2 for results. The memo is included in Appendix C.

2.4. Event 4 (September/October 2014)

2.4.1. Groundwater Monitoring Wells

During Event 4, 70 groundwater monitoring wells were sampled, consisting of 35 bladder pump wells and 35 PDB wells. Monitoring well 04BW04 was not sampled due to construction in the vicinity of the Genie parking lot. Groundwater elevation data were also obtained from monitoring wells with bladder pumps and PDBs.

The set of 35 PDBs that had previously been installed were sampled in September, and new PDBs were deployed into those same monitoring wells in preparation for the November 2014 sampling event. This change in sampling protocol improved efficiency and cost by eliminating a separate field trip for PDB deployment, which had been the practice in the past. Groundwater elevation data are taken before the PDB to be sampled is retrieved.

2.4.2. Private Wells

During Event 4, eight private wells with WHF systems were sampled as described below. Four of the WHF wells (WP-121, WP-123, WP-124, and WP-129) were sampled from the influent, mid, and effluent sampling ports to determine the presence of TCE in the influent port and confirm the efficiency of the filters; WP-119 was not sampled in Sep 2014 due to disconnection of electrical service at the apparently vacant property. Four of the WHF wells (WP-14, WP-70, WP-83 and WP-86) were sampled from the influent port only to collect data for the seasonal trend analysis and to confirm that TCE concentrations did not change significantly. Before sample collection, totalizing flow meter readings were recorded.

Six other private wells (WP-04, WP-125, WP-131, WP-167, WP-168, and WP-27) were sampled in Event 4. Data collected from these wells will be used for seasonal trend analysis. Private wells WP-88 and WP-

137 and WHF system WP-119 were scheduled for sample collection during this event, but power was turned off at those properties and therefore water samples could not be obtained.

2.5. Right of Entry (ROE) Acquisition

Right-of-Entry (ROE) forms are used to obtain permission to enter onto property to conduct water sampling. In general, USACE only obtained ROEs from property owners (and tenants, if applicable) where a well is located. During 2014 sampling year, USACE was unable to acquire ROEs for the following wells:

- WP-11: [redacted], the owner, indicated [redacted] did not want the Government involved with [redacted] property. [redacted] is on well water.
- WP-77: [redacted], the owner, is now on city water. [redacted] has a broken pump and does not have the means to fix it.
- WP-15W: This system has not been sampled by USACE because it is apparently a back-up system. The [redacted], and [redacted] has been unwilling to meet with USACE to sign ROEs for this system. [redacted] is electrically unsafe. Due to lack of an ROE and for safety reasons, this well was not sampled.
- WP-25W: The Hillcrest Water Users Association POC ([redacted]) is unwilling to sign an ROE but is willing to unlock the area so that USACE can sample. Therefore, USACE has been sampling. [Note: Going forward, USACE will not sample at any properties where we cannot obtain ROEs.]
- WP-119: An ROE existed with the owner of this property in early 2014; however, [redacted] in September, so it was not sampled for Event 4 and no obtained at that time.

USACE will continue to make an attempt at least annually (anticipated during the annual May event) to acquire an ROE. USACE also updated the ROE form in 2014 at EPA's request to provide two duration options for owners: either five years, or until remedial action is complete.

3. ANALYSIS, DATA VALIDATION, AND RESULTS

The sections below discuss briefly the analytical and data validation procedures, and then the groundwater elevations and analytical results for monitoring/extraction wells and private wells. A comprehensive table of analytical results is included in Appendix B; individual tables with results by well type are discussed below and provided in Table 3, Table 4, and Table 5. Time-series plots of TCE concentrations are provided in Appendix D. Complete laboratory data packages for all samples are attached as Appendix E. Results can also be viewed online at http://geo.usace.army.mil/egis/cm2.cm2.map?map=MOSESLAKE.

3.1. Analytical and Data Validation Procedures

All sampling and analytical activities were executed in compliance with project data quality objectives (DQOs), and results are considered acceptable for use.

The analytical laboratory used for this project was Analytical Resources, Inc. (ARI) of Tukwila, WA. Samples were analyzed by EPA Method 524.3 for VOCs. The method produces data with the analytical sensitivity required to evaluate whether drinking water meets the Federal MCLs. A Quality Control Summary Report (QCSR) summarizing analytical performance expressed in terms of data quality indicators (DQIs) can be found in Appendix F.

Laboratory Data Consultants, Inc. (LDC) of Carlsbad, CA, performed the data validation task. The Data Validation Report (DVR) presents Stage 2a and Stage 4 data validation results for samples collected. Data validation was performed in accordance with the USACE-prepared Work Plan-QAPP (USACE May 2014); Chemical Data Quality Management Support Services Statement of Work (SOW) (USACE February 2012); U.S. Department of Defense Quality Systems Manual for Environmental Laboratories, Version 5.0 (DOD QSM) (13 July 2013); and Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review (CLPNFG) (June 2008). A full chemical Data Validation Report is provided in Appendix G. Based on the data quality assessment presented in the QCSR and the DVR, the overall quality of data is known and acceptable for the intended use.

Water samples and associated quality control (QC) samples were collected from groundwater monitoring wells and private wells in accordance with the 2014 USACE Work Plan-QAPP. Field QC samples included field duplicates, field blanks, trip blanks, matrix spikes (MS), and matrix spike duplicates (MSDs). A performance evaluation (PE) sample, provided by Environmental Resource Associates of Arvada, CO, was submitted for VOC analysis.

3.2. Monitoring Wells - Results

3.2.1. Groundwater Elevations

Groundwater elevations, summarized in Table 2, were collected from 71 monitoring wells during Event 3 and from 70 monitoring wells during Event 4. Golden Software's Surfer® program, with Kriging selected as the interpolation method, was used to produce groundwater elevation contours of the BW and CW monitoring wells (Priest Rapids-Roza1 aquifer and Roza 2 aquifer, respectively). The general flow direction in the Priest Rapids-Roza 1 aquifer in the northern portion of the Site is to the southwest (see Figure 7), which is consistent with previous groundwater elevation data. The groundwater flow direction within the south plume is southerly, which is consistent with previous groundwater elevation data.

The flow direction in the Roza 2 aquifer radiates to the northwest and south from well 12CW03; well 12CW03 is located in the northern portion of the south plume (see Figure 8). The contours were blanked between 12CW04 and the other CW monitoring wells to the north due to lack of data. The exact location of the peak elevation of the groundwater in the Roza 2 aquifer is not known due to this lack of data.

The software-generated groundwater contours were reviewed by a hydrogeologist and deemed to be accurate. The data for the groundwater elevation figures are based on Event 3 (May 2014) only.

3.2.2. Analytical Results

Analytical results for the groundwater monitoring and extraction wells are provided in Table 3 and shown in Figure 9 (Priest Rapids-Roza 1) and Figure 10 (Roza 2). The maximum TCE results (i.e., from whichever event had the highest concentration during the sampling year) were used to generate Figures 9 and 10. Forty-six wells had detected concentrations for TCE, and a subset (six) also had cis-DCE detections. Twenty-five of those 46 wells exceeded the MCL (5.0 µg /L) for TCE. The maximum TCE detection was 88.2 µg /L in the Priest Rapids- Roza 1 aquifer at well 12BW05 in June 2014. The maximum detection of cis-DCE was 2.77 µg /L in the Priest Rapids- Roza 1 aquifer at well 04BW06 in June 2014. TCE and cis-DCE were the only COCs detected out of the eight analytes evaluated in 2014. Twenty-five wells had no COCs reported above the analytical reporting limit (i.e., were non-detect).

The maximum TCE detection in the Roza 2 aquifer was 5.73 µg/L at well 04CW07 in June 2014 (an increase from 4.80 µg/L in 2013). Well 04CW07 is the only Roza 2 monitoring well that exceeded the TCE MCL; it is located below the southern portion of the south plume. There were no cis-DCE detections in the Roza 2 aquifer.

3.3. Private Wells without WHFs– Results

This section summarizes results for private wells without WHFs. However, because WHFs were installed at WP-123, WP-124, and WP-129 at different times during the sampling year, results may be summarized both in this Section and in Section 3.4.

3.3.1. Groundwater Elevation

Due to the risk of entangling the water level indicator cord with private well pumps, groundwater elevation data were not collected from private wells. In addition, unless the residents' and neighbors' use of water could be controlled, the elevations collected would not be indicative of natural contours.

3.3.2. Analytical Results

Analytical results for the private wells without WHFs are provided in Table 4. TCE and cis-DCE were the only COCs detected out of the eight analytes evaluated in 2014. Of the 63 private well locations sampled (not including WHFs), 12 locations had results less than the detection limit (0.2 µg/L). Fifty-two wells (52) had TCE detections, but none exceeded the MCL during the 2014 sampling year. Of the 52 wells with TCE detections, five wells (WP-04, WP-125, WP-131, WP-167, and WP-168) had TCE concentrations above 2.0 µg/L for at least one event and were sampled quarterly. A sixth well, WP-27, was also sampled quarterly during the 2014 sampling year because it had historical detections greater than 2.0 µg/L; however, none of the 2014 results were above 2.0 µg/L.

The maximum TCE detection was 4.89 µg/L at WP-04 in October 2014. Well WP-04 is used for industrial process water and has had TCE concentrations that fluctuate around the MCL. Between November 2013 and September 2014 the TCE concentrations ranged from 4.32 - 4.89 µg/L, and the graph in Appendix D shows a rising trend. No WHF is needed at this location because the water is not being used for consumption. The business associated with WP-04 has previously been informed of the elevated risk associated with TCE and has been asked to provide signage stating that well water should not be used for human or animal consumption.

A TCE concentration of 3.82 µg/L was recorded at WP-123 during Event 3 (June 2014) (see Table 5). Because this value exceeded the 3.5 µg/L TCE action threshold to protect human health, a WHF was installed in September 2014, prior to Event 4.

Seven private wells had cis-DCE detections. The maximum detection was 1.56 µg/L at well WP-04 in October 2014, which was considerably below the cis-DCE MCL (70 µg/L).

3.4. Private Wells with WHFs – Results

The analytical results and the efficiency of the WHFs are discussed below.

3.4.1. Results

Table 5 summarizes the analytical results for TCE and cis-DCE for the wells with WHFs. Table 6 summarizes purge volumes collected prior to sampling at WHF wells. For the 2014 sampling year, the WHFs were successful in reducing TCE and cis-DCE to undetected concentrations in the effluent ports, which lead into the homes. The mid port sample for WP-83 had a cis-DCE detection in May 2014 (0.17 J µg/L); however, the effluent sampling results for all WHFs (including WP-83) were non-detect (and therefore not shown in Table 5), indicating that the WHFs are working effectively.

During Event 3 (May/June 2014), WP-123 (at that time without a WHF) had influent TCE concentrations that exceeded the action threshold of 3.5 µg/L. For this reason, a WHF was installed in September 2014, prior to Event 4 (September/October 2014). Sampling results from Event 4 show that the WHF at WP-123 was working effectively, because results were non-detect in the mid and effluent samples.

Due to a misunderstanding in the field during Event 3, only a spigot at the home with well WP-124 was sampled instead of the WHF system; however, that sample was representative of the effluent port and it was non-detect.

3.4.2. Whole House Filter Efficiency Analysis

A memorandum (memo) to evaluate the efficiency of the Siemens AWC-1230 WHF systems installed in May 2013 at Moses Lake residential wells WP-14, WP-70, WP-86, and WP-83 was completed in September 2014 (covering four events during August 2013 – May 2014). The 2014 Whole House Filter Efficiency Memo is located in Appendix C. The memo evaluated whether the filters worked sufficiently for a year to protect residents from exposure to TCE concentrations greater than the MCL. In addition, this memo evaluated whether there was sufficient evidence to reduce filter sampling frequency (from quarterly to something less frequent).

The memo summarized that the WHFs are working sufficiently to ensure protection of human health. For example, WP-14 experienced moderate to high average flow rates and the highest TCE and cis-DCE concentrations at the lead (influent) sample port. Under these conditions, the WHF was successful in reducing TCE and cis-DCE to undetected concentrations throughout four quarters of evaluation. WP-83 experienced the highest flow rate and had moderately high TCE and cis-DCE influent concentrations. The cis-DCE and TCE mass loading over the year for WP-83 was not as great as for WP-14, although WP-83 did have a detection of cis-DCE from the mid port sample (0.17 J μg/L; the cis-DCE MCL is 70 μg/L) during the fourth quarter of testing (May 2014). This evidence suggests that the high average flow rate observed at WP-83 reduced the efficiency of the WHF, but was not enough to cause a health concern because TCE and cis-DCE concentrations were non-detect in the effluent samples.

The memo recommended reducing the frequency of sampling for the mid and effluent ports from quarterly to annually, but maintaining the influent port sampling at quarterly to collect data to support seasonal trend analyses. See also Section 5.2.

3.5. Time-Series Plots

In 2014, EPA requested that USACE produce TCE time-trend graphs for the 2014 Annual Report. These graphs are located in Appendix D and include wells with four or more previous detections for TCE. The graphs include monitoring wells, private wells that have been sampled annually, and a subset of private wells that have been sampled quarterly. The subset depicts wells that have had concentrations greater than 2.0 μg/L TCE.

3.6. Top of Basalt and Top of Ringold Formation Data

In 2014, EPA also requested that USACE produce figures showing the top of basalt and the top of Ringold formation data. These figures are Figure 11 and Figure 12, respectively. For clarification, the top of basalt elevation is defined by the surface of the Priest Rapids Basalt where present, and by the Rosa 1 Basalt otherwise. The generation of these figures is described as follows.

Various wells were excluded from contouring and/or labeling (e.g., on the map/legend) based on well log quality and on agreement with nearby wells and regional trends. Wells with poor quality well logs and/or uncertain contact (e.g., formation surface elevation) boundaries were also excluded from contouring and labeling. In instances where two directly adjacent wells were in significant disagreement on contact elevation, the well that was more in agreement with local/regional trends was included, and the other well was excluded from contouring and labeling.

For the Ringold formation, some wells were excluded from contouring but still included in labeling for the following reasons. Wells 99AW03 and 12CW02 were excluded from contours and labeling due to severe disagreement with adjacent wells and local trends, which was interpreted as an indication of well logging error. Additionally, there is an area in the lower center portion of the contoured area (south plume) with a very high density of wells; this is the region with most of the 2012 and 2014 wells. This area also appears as a locally elevated area in the Ringold formation, albeit with an uneven surface. Reported elevations in a very dense area ranged from 1050 to 1075 feet, with most points in the 1060s. Due to the variability, this area was essentially not able to be contoured. To deal with this, wells within this small area with contact elevations reported below 1060 feet or above 1070 feet were excluded from contours, in order to allow somewhat clearer contours to be shown. Wells excluded from Ringold contours include 04BW04, 04BW09, 01BW01, 99BW13, 04CW01, 12BW07, 12EZ01, 12CW04, and 14BW02.

For the top of basalt figure, all AW wells were excluded from contours and labeling due to poor characterization of the top of basalt elevation in the well logs. Wells 04CW05, 12CW02, 04CW07, and 01BW01 were excluded from contours and labeling due to severe disagreement with neighboring wells and local trends.

3.7. Customer Notification of 2013 and 2014 Results

The results from the 2013 Sampling Program were mailed to the Moses Lake residents in January 2014. The results from the 2014 Sampling Program (i.e., the focus of this 2014 Annual Report) were mailed to the Moses Lake residents on February 6, 2015.

4. State Well Inventory Database Search

To determine whether additional private wells were installed within or near the VOC plume, information from the Washington State Department of Ecology (WDOE) Well Logs database (https://fortress.wa.gov/ecy/waterresources/map/WCLSWebMap/textsearch.aspx) was queried. The results of query are provided in Appendix H. Well logs can be found in Appendix I.

The database was searched for wells constructed or well logs received between January 1, 2013 and December 15, 2014 and screened or open to the upper basalt flows in Priest Rapids-Roza 1 and Roza 2 geologic members (see Figure 3). Following the Groundwater Institutional Control Boundary (see Figure 2), all or portions of the following Township, Range, and Sections were queried: T19N, R28E, Sections 4, 5, 6, 7, 8, 9, 16, 17, 18 and T20N, R28E, Sections 16, 17, 19, 20, 21, 22, 27, 28, 29, 30, 31, 32, 33, 34.

Eight private wells were installed (USACE/EPA not involved) between January 1, 2013 and December 15, 2014. Two wells (BHW004 and BHW172) are located within the northern portion of Cascade Valley. BHW004 has been included in the sampling program and is designated WP-178. BHW172 is located 1385 feet north of Dick Road and was the only new well recommended for sampling; it was drilled in February 2014, designated WP-179, and sampled in Event 3. It appears to be drawing groundwater from the upper basalt members. Groundwater from these formations has historically had VOC contamination in some areas.

Of the remaining six wells, one is located 820 feet south of Dick Road but is surrounded by other wells with no historic detections. The other five wells are located from 2955 to 6535 feet south of Dick Road, far from any historic contaminant detections.

5. Summary and Discussion

Summary and discussion of the TCE plume and WHF work for the four sampling events in 2014 is provided below.

5.1. Site TCE Plume Discussion

The results of the 2014 sampling program indicate that the TCE MCL of 5.0 µg/L was exceeded in approximately 25 of the 70 monitoring and extractions wells (36%), primarily in the BW monitoring wells. Regarding the private wells, approximately 61 of the 72 private wells (including WHFs) located in the Cascade Valley had detections of TCE (> 0.20 µg/L) during the 2014 sampling year; however, no private wells exceeded the TCE MCL of 5.0 µg/L.

TCE plume contours of the 5.0 µg/L TCE MCL, the action threshold of 3.5 µg/L TCE, and the recommended quarterly sampling level 2.0 µg/L were developed based on the 2014 data and are summarized in Figure 6, Figure 9, and Figure 10. For well locations where two or more data points were available in 2014, the highest value was used for contouring. The contours were initially generated using the Kriging gridding method in Golden Software's Surfer® program Version 8, which numerically estimates plume boundaries based on input data. The Surfer® Kriging method was used on log-transformed concentration data to produce more systematic and repeatable contouring compared to manually only developed contouring methods historically used for the Site. Where deemed appropriate, the computer generated contours were adjusted based on professional judgment (e.g. open ended contours where there are data gaps). The main plume is open-ended to the southwest due to lack of monitoring well data in the downgradient direction. The northeast plume is only defined by one monitoring well (99BW15) and two private wells (WP-14 and WP-83). The northeast plume contours are open to the northeast due to lack of data in the upgradient direction. The south plume is more continuous, with the highest concentration of 88.2 µg/L at well 12BW05 (an increase from 78.2 µg/L in 2013).

It is anticipated that private wells, including those in the Cascade Valley, draw water from the upper basalt aquifers (Priest Rapids-Roza 1 and Roza 2) and potentially the overlying alluvium. However, limited private well construction information makes it difficult to correlate individual private wells with a specific aquifer. In addition, there are only two groundwater monitoring wells located within the Cascade Valley, and they are too distant from the other clusters of monitoring wells to help delineate the origin of groundwater contamination occurring in the Cascade Valley. The majority of private wells in Cascade Valley are downgradient from or near the leading edge of the contaminant plume. Several of the wells sampled in the Cascade Valley area are immediately downgradient of the main (north) and/or south plumes. Until additional monitoring wells become available to track the plume, data from private wells is being used to help understand plume migration. Additional monitoring wells upgradient of Cascade Valley are needed to refine the CSM, help predict TCE concentrations at residential wells, and delineate the extent of TCE contamination in the Roza 1 versus Roza 2 aquifers.

TCE results from WP-04 have shown contaminant concentrations above or near the TCE MCL over the last two years (4.7 µg/L in 2012, 5.48 µg/L in 2013, and 4.89 µg/L in 2014). Four WHF systems are clustered near WP-04 and are likely drawing contaminated groundwater associated with the main plume. Contours around WP-04 are open to the northeast due to lack of data in the upgradient direction. Current data suggest that the private wells downgradient of WP-04 (generally southwest, see Figure 6) without WHF systems are the most at risk of exceeding the TCE MCL. Based on the groundwater elevation contours for BW monitoring wells (Figure 7) and the 2014 TCE contours (Figure 9), the source of TCE contamination in the northern Cascade Valley could be from the main TCE plume or an unidentified source.

Following the June 2013 sampling event, a value of 2.0 µg/L TCE was recommended by USACE and agreed to by EPA as the lower threshold value above which private wells would be monitored quarterly for a minimum of one year given the limited amount of available historic data for private wells. This recommendation was made to evaluate groundwater fluctuations based on seasonal changes (i.e., change in irrigation activities, decrease in precipitation, etc.) and determine whether fluctuations would necessitate action to prevent ingestion of contaminated drinking water. This recommendation for quarterly sampling of private wells continued in 2014 to generate data for trend analyses.

Due to the presence of multiple contaminant plumes and uncertainty of private well construction, all other private wells within the Moses Lake area with any historic COC detections are recommended for annual sampling until a better understanding of plume migration has been documented. Additional houses may be added based on their proximity to wells with elevated concentrations.

5.2. Whole House Filters

In summary, the WHFs are working as intended and reducing cis-DCE and TCE concentrations in effluent samples (i.e., in the water that is supplied to the homes) below both the MCLs and the detection limits for each. The WHF GAC vessels were exchanged annually; the fines filters were replaced every six months, and the WHF systems were also inspected for general functionality at that time. Only one new WHF was installed during the 2014 sampling year at WP-123 in September 2014. The results of the WHF efficiency analysis confirmed that the WHFs are working as intended. Based on discussion with EPA in September 2014, the frequency of WHF port sampling (going forward) was confirmed as follows:

- In the first year after installation, all ports (influent, mid, effluent) will be sampled quarterly.
- At end of first year, the efficiency analysis will be performed.
- In the second year (assuming all is well based on the analysis), the influent port will be sampled quarterly, and the mid and effluent ports annually.
- At end of the second year, a seasonal analysis will be done to decide which quarter is best for annual sampling, with the preference of having the majority of the WHFs on the same schedule.
- In the third year and beyond, all three ports would be sampled only annually.

USACE will strive to put the WHFs on the same schedule for annual sampling.

6. Recommendations

Recommendations from the 2014 sampling program are provided below.

6.1. Groundwater Monitoring Wells

- Evaluate historical groundwater elevation data and TCE concentrations for evidence of seasonal fluctuations to ensure conservative timing of future optimized annual sampling events in the groundwater monitoring program.

- Evaluate recent groundwater elevation data collected in support of the 2017 south plume pump and treat system startup in parallel with historic groundwater information to ensure sufficient baseline data are available to support pump and treat system optimization analysis following start-up of the south plume pump and treat system.

- There are currently only two monitoring wells located in Cascade Valley. The monitoring well pair is located just south of Dick Road, which is approximately one mile south of the main plume. Installation of additional monitoring wells in the northern part of Cascade Valley is recommended to refine the conceptual site model and determine the source of the TCE impacting the private wells.

- Installation of monitoring wells in the Roza 1 basalt aquifer upgradient of Cascade Valley (generally upgradient of WP-04) and downgradient of 04BW06 is recommended to better define the origin of contaminant concentrations in the private wells of Cascade Valley. Presently, it is unclear whether contamination impacting the N. Cascade Valley is coming from the distal portion of the Main Plume, or another unidentified TCE source. In addition, a review of private well boring logs is recommended to determine those well completion elevations so that those elevations can be used to determine where to install new monitoring wells.

- Enter monitoring well boring logs and WDOE driller logs (when deemed suitable for interpretation) into a geologic database so that subsurface cross-sections can be readily generated through the main and south plumes and into Cascade Valley.

6.2. Private Wells

- Continue collecting annual groundwater samples from all private wells with any historic COC detections on an annual basis to document plume migration.

- Continue updating the sampling program by adding new private wells, small public water systems (and monitoring wells) with high likelihood of COC detections as they are identified through Department of Ecology's well log database.

- For private wells that exceed 2.0 μg/L TCE, continue collecting quarterly groundwater samples for at least four quarters to evaluate patterns in seasonal and temporal system variability that support future sampling frequency and timing recommendations.

- Continue to communicate with residents who have not agreed to groundwater monitoring but are located in areas anticipated to have elevated TCE concentrations. Document that the residents have declined to participate in the monitoring program and that the Government has informed residents of the risks associated with exposure to water exceeding the MCL for TCE.

- Conduct a comprehensive review of WDOE drillers' logs versus assigned private well numbers (WP series) and evaluate whether WDOE logs are suitable for interpretation in a geologic database.

6.3. Whole House Filter Systems

- Continue to install and maintain WHF systems at private wells that exceed the action threshold of 3.5 μg/L TCE.

- Continue to monitor the efficiency of WHF systems by tracking if TCE exceeds its action level of 3.5 μg/L at the mid or effluent ports, and take steps to correct any issues.

- Use information from the WHF totalizing flow meters, which measure the volume of water treated by the WHF systems, to monitor and evaluate the efficiency of the treatment systems.

- Over time, if concentrations at the influent ports to WHFs decline, work with EPA to determine which WHFs can be removed from residential wells.

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Figures

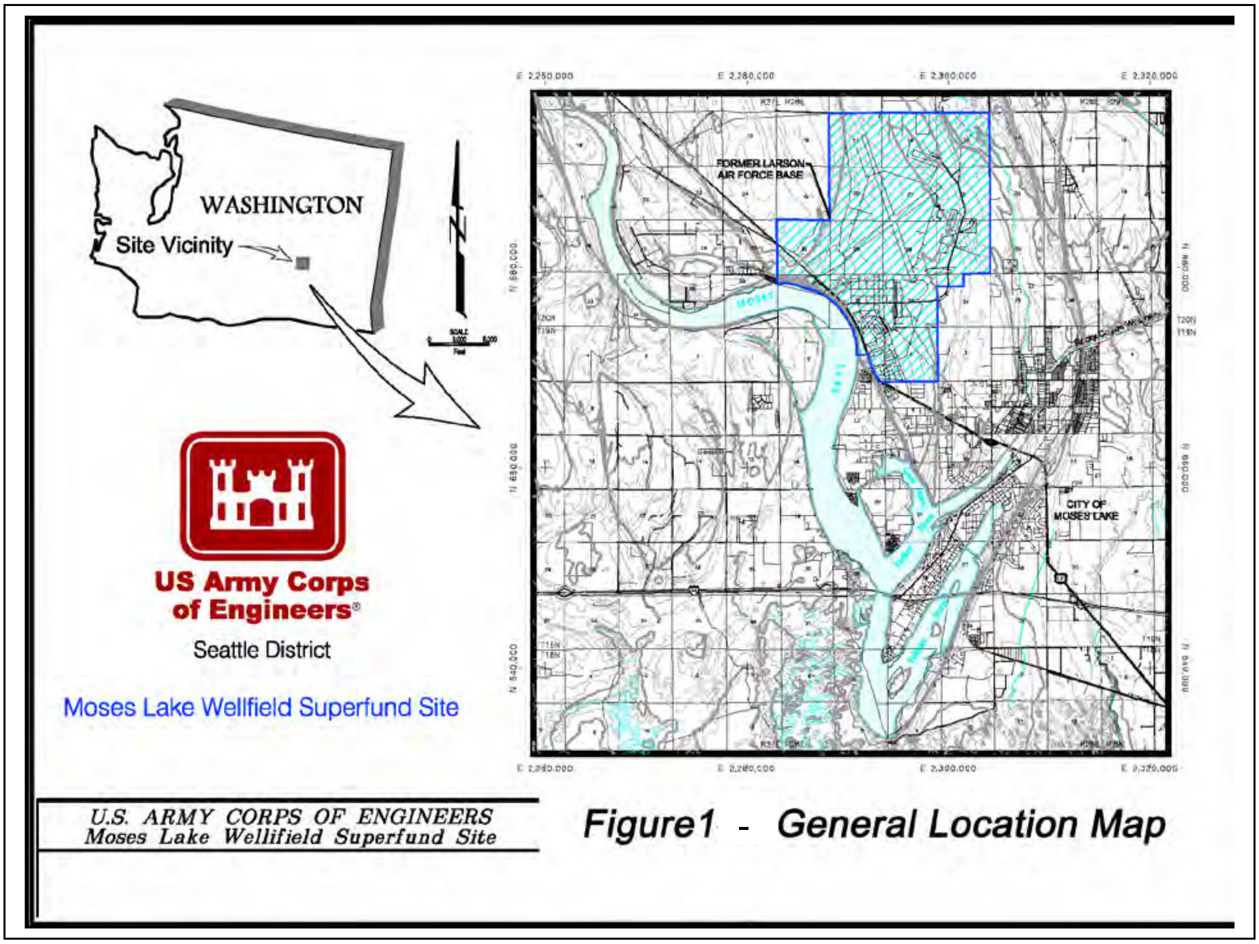

Figure 1. General Location Map for Moses Lake Wellfield Superfund Site (EPA 2008).

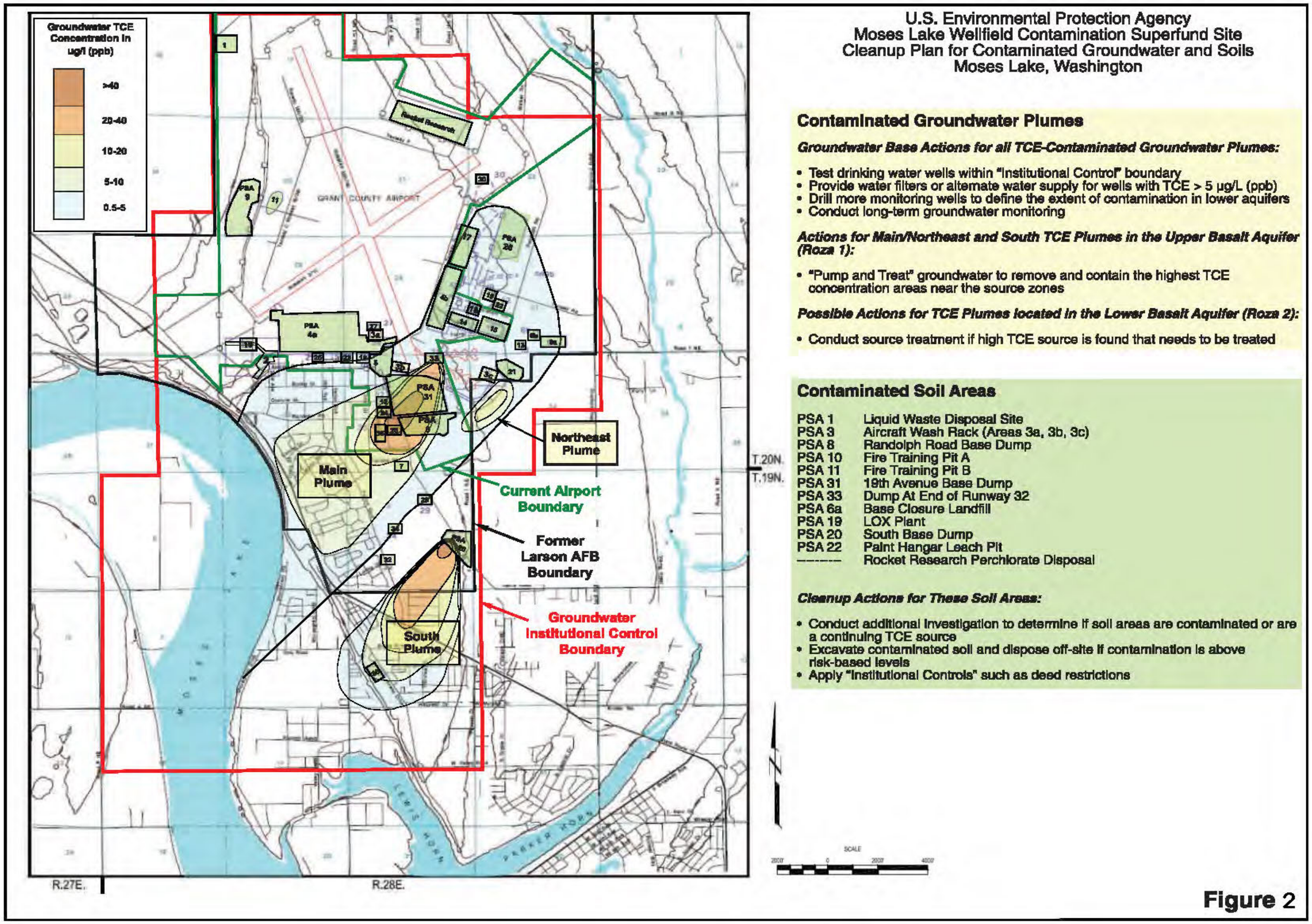

Figure 2. Contaminant Boundaries from the Interim Record of Decision (EPA 2008).

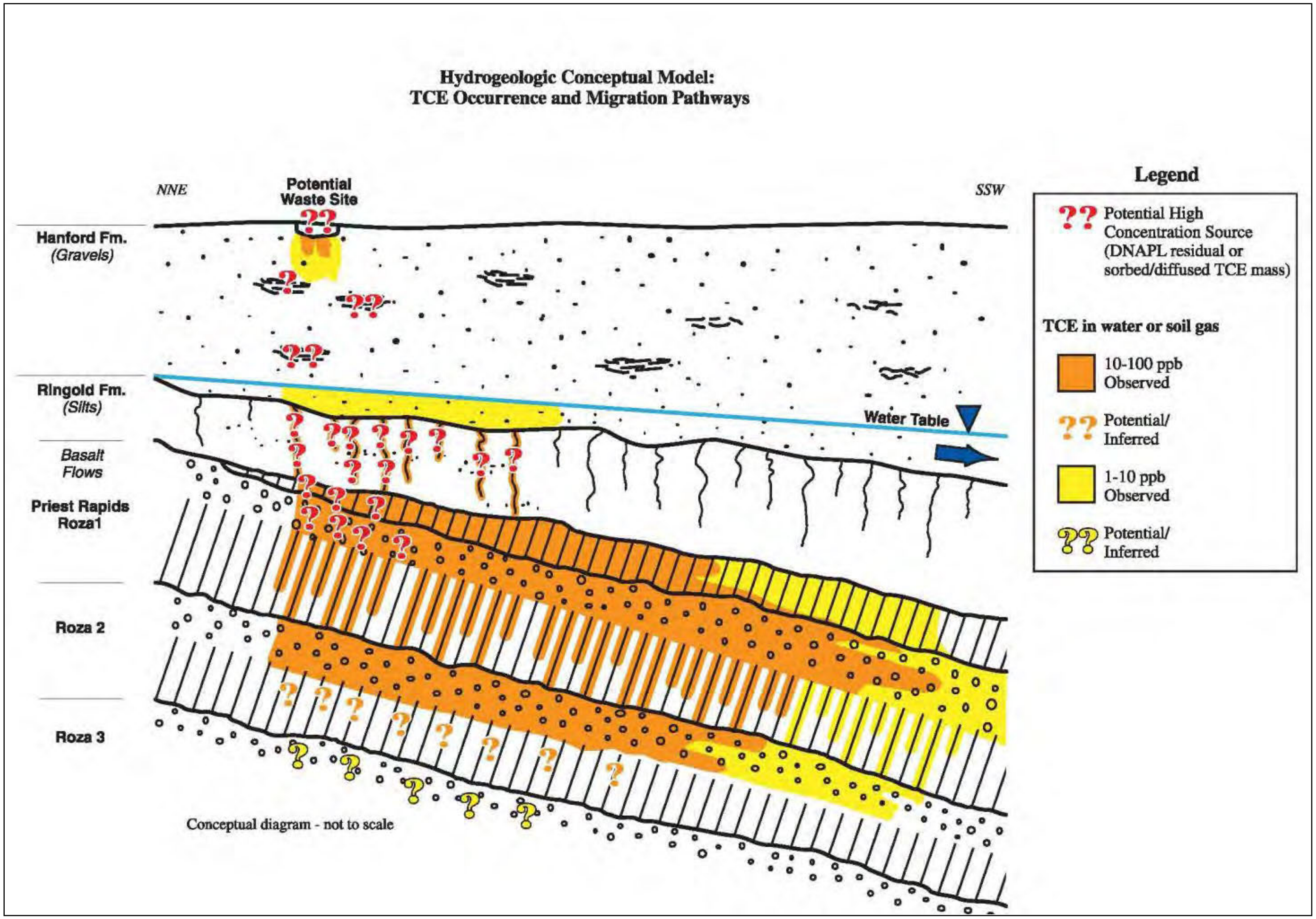

Figure 3. Hydrogeologic Conceptual Model (EPA 2008)

NOTE: Figures are located after the Figure titles below.

Figure 4. Map of Wells and Sampling Status for 2014

Figure 5. Map of Wells - Cascade Valley Inset

Figure 6. Cascade Valley Inset with TCE Contours and Results (Highest Value Shown)

Figure 7. Priest Rapids-Roza 1 Monitoring Wells (BW series) with Groundwater Elevations (May 2014 Results)

Figure 8. Roza 2 Monitoring Wells (CW series) with Groundwater Elevations (May 2014 Results)

Figure 9. Priest Rapids-Roza 1 Monitoring Wells (BW series) with TCE Contours and Results (Highest Value Shown)

Figure 10. Roza 2 Monitoring Wells (CW series) with TCE Contours and Results (Highest Value Shown)

Figure 11. Top of Basalt Elevation (Feet)

Figure 12. Top of Ringold Formation Elevation (Feet)

Tables

Table 1. Wells Sampled during Events 1, 2, 3, and 4

Table 1.	November 2013		February 2014		May/June 2014		September/Oct 2014	
Well ID	COC	GW. Elevation	COC	GW. Elevation	COC	GW. Elevation	COC	GW. Elevation
00AW11					X	X	X	X
00AW13					X	X	X	Not recorded
00BW01					X	X	X	X
00BW02					X	X	X	X
00BW03					X	X	X	X
00BW04					X	X	Not Sampled	X
00BW05					X	X	X	X
00BW06					X	X	X	X
00BW07					X	X	X	X
00BW09					X	X	X	X
00BW10					X	X	X	X
00BW11					X	X	X	X
00BW12					X	X	X	X
00BW13					X	X	X	X
00BW14					X	Not recorded	X	X
00BW15					X	X	X	X
00BW16					X	X	X	X
01BW01					X	X	X	X
02BW01					X	X	X	X
02BW02					X	X	X	X
04BW01					X	X	X	X
04BW04					X	X	X	X
04BW05					X	X	X	X
04BW06					X	X	X	X
04BW07					X	X	X	X
04BW09					X	X	X	X
04CW01					X	X	X	X
04CW02					X	X	X	X
04CW03					X	X	X	X
04CW04					X	X	X	X
04CW05					X	X	X	X
04CW07A					X	X	X	X
04CW07B					X	Not recorded	X	Not recorded
04CW08					X	X	X	X
12BW01					X	X	X	X
12BW02					X	X	X	X
12BW03A					X	X	X	X
12BW03B					X	Not recorded	X	Not recorded

Table 1.	November 2013		February 2014		May/June 2014		September/Oct 2014	
Well ID	COC	GW. Elevation	COC	GW. Elevation	COC	GW. Elevation	COC	GW. Elevation
12BW04A					X	X	X	X
12BW04B					X	Not recorded	X	Not recorded
12BW05					X	X	X	X
12BW06					X	X	X	X
12BW07					X	X	X	X
12BW08					X	X	X	X
12CW01					X	X	X	X
12CW02					X	X	X	X
12CW03					X	X	X	X
12CW04					X	X	X	X
12CW05					X	X	X	X
12EX01					X	X	X	X
12EX02					X	X	X	Not recorded
14BW01					X	X	X	Not recorded
14BW02					X	X	X	Not recorded
14BW03					X	X	X	Not recorded
14EX03					X	X	X	Not recorded
14EX04					X	X	X	Not recorded
14EX05					X	X	X	Not recorded
91BW02					X	X	X	Not recorded
91BW03					X	X	X	X
91BW04					X	X	X	X
92BW01					X	X	X	X
92BW02					X	X	X	X
99AW01					X	X	X	X
99AW04					X	X	X	Not recorded
99AW09					X	X	X	X
99BW01					X	X	X	X
99BW09					X	X	X	X
99BW10					X	X	X	X
99BW11					X	X	X	Not recorded
99BW12					X	X	X	X
99BW14					X	X	X	X
99BW15					X	X	X	X
99BW16					X	X	X	X
99BW18					X	X	X	X
WP-03					X			
WP-04					X		X	
WP-09					X			

Table 1.	November 2013		February 2014		May/June 2014		September/Oct 2014	
Well ID	COC	GW. Elevation	COC	GW. Elevation	COC	GW. Elevation	COC	GW. Elevation
WP-10					X			
WP-105					X			
WP-111					X			
WP-116					X			
WP-118					X			
WP-119	X		X		X			
WP-120					X			
WP-121	X		X		X		X	
WP-122					X			
WP-123	X		X		X		X	
WP-124	X		X				X	
WP-125	X		X		X		X	
WP-126					X			
WP-127					X			
WP-128					X			
WP-129	X		X		X		X	
WP-130					X			
WP-131	X		X		X		X	
WP-136					X			
WP-138					X			
WP-139					X			
WP-13E					X			
WP-14	X		X		X		X	
WP-143					X			
WP-144					X			
WP-145					X			
WP-147					X			
WP-148					X			
WP-149					X			
WP-150					X			
WP-151					X			
WP-152					X			
WP-153					X			
WP-154					X			
WP-155					X			
WP-156					X			
WP-164					X			
WP-165					X			
WP-167	X		X		X		X	

Table 1.	November 2013		February 2014		May/June 2014		September/Oct 2014	
Well ID	COC	GW. Elevation	COC	GW. Elevation	COC	GW. Elevation	COC	GW. Elevation
WP-168	X		X		X		X	
WP-169					X			
WP-172					X			
WP-175					X			
WP-177					X			
WP-178					X			
WP-179					X			
WP-180					X			
WP-18N					X			
WP-18S					X			
WP-25W					X			
WP-27	X		X		X		X	
WP-28					X			
WP-33					X			
WP-45					X			
WP-50					X			
WP-52					X			
WP-54					X			
WP-57					X			
WP-65					X			
WP-66					X			
WP-68					X			
WP-69					X			
WP-70	X		X		X		X	
WP-71A					X			
WP-71B					X			
WP-74					X			
WP-82					X			
WP-83	X		X		X		X	
WP-86	X		X		X		X	

Note: A few wells are screened at two depths (12BW03, 12BW04, and 04CW07) but are considered one well each.

Table 2. Monitoring Wells – Groundwater Elevations

Table 2. Well ID	Event 3 Elevation (ft)	Event 4 Elevation (ft)	Screened Interval Depth (ft)	Bladder Pump Installed?	Stick Up or Flush Mount	NAD 83 Coordinates	
91BW02	1076.88		137-147	Yes	Stick Up	47.1928770	119.3157860
91BW03	1070.76	1071.17	170-180	Yes	Stick Up	47.1802182	119.3120708
91BW04	1066.59	1066.97	178-188	Yes	Stick Up	47.1713790	119.3073365
92BW01	1072.00	1072.34	143-153	Yes	Stick Up	47.1809685	119.3065541
92BW02	1072.00	1072.51	147-157	Yes	Stick Up	47.1795228	119.3059859
99AW01	1071.06	1071.70	101-111	Yes	Stick Up	47.1803400	119.3116700
99AW04	1045.91		48-58	Yes	Flush Mount	47.1530080	119.3254000
99BW01	1070.87	1071.26	141.5-151.5	Yes	Stick Up	47.1803111	119.3116511
99AW09	1063.43	1064.13	97.5-107.5	Yes	Stick Up	47.1607050	119.3047100
99BW09	1024.99	1023.25	110-120	Yes	Stick Up	47.1506034	119.2937891
99BW10	1038.41	1038.62	175-185	Yes	Flush Mount	47.1545429	119.3092773
99BW11	1025.55		102-112	Yes	Flush Mount	47.1530170	119.3252970
99BW12	1064.23	1063.56	162-172	Yes	Flush Mount	47.1682510	119.3102755
99BW14	1070.10	1070.70	85-95	Yes	Stick Up	47.1827578	119.2956149
99BW15	1075.04	1075.11	90-100	Yes	Flush Mount	47.1885144	119.3274129
99BW16	1063.66	1062.86	146-156	Yes	Stick Up	47.2203616	119.3148646
99BW18	1054.74	1055.69	143-153	Yes	Stick Up	47.1900785	119.2861595
00AW11	1071.86	1072.18	81-91	Yes	Stick Up	47.1808700	119.3064300
00AW13	1055.88		127.5-137.5	Yes	Flush Mount	47.1603870	119.3191020
00BW01	1081.91	1082.59	68-78	Yes	Stick Up	47.1826381	119.3064162
00BW02	1074.02	1074.16	87-97	Yes	Stick Up	47.1854093	119.3033449
00BW03	1073.61	1074.33	85-95	Yes	Stick Up	47.1924455	119.2981920
00BW04	1082.54	1082.92	70-80	Yes	Stick Up	47.1954350	119.2945177
00BW05	1084.29	1084.62	80-90	Yes	Stick Up	47.1898020	119.3388483
00BW06	1051.86	1050.25	180-190	Yes	Stick Up	47.1920426	119.3014964
00BW07	1078.92	1079.35	75-85	Yes	Stick Up	47.1922928	119.3162634
00BW08	1076.28	1076.38	92-102	Yes	Stick Up	47.1923400	119.3162700
00BW09	1083.39	1083.91	79.5-89.5	Yes	Stick Up	47.1478261	119.3078725
00BW10	1019.54	1019.46	186.2-196.2	Yes	Stick Up	47.1884236	119.3179383
00BW11	1071.66	1071.29	107-117	Yes	Flush Mount	47.1882448	119.3048505
00BW12	1073.04	1073.75	101-111	Yes	Stick Up	47.1657642	119.3016310
00BW13	1069.36	1069.76	133-143	Yes	Stick Up	47.1913619	119.2883084
00BW14		1083.82	62-72	Yes	Flush Mount	47.1913680	119.2883230
00BW15	1073.61	1073.99	105.6-115.6	Yes	Stick Up	47.1603980	119.3191815
00BW16	1039.42	1038.32	186.4-196.4	Yes	Stick Up	47.1965781	119.2958972
01BW01	1038.55	1040.01	85-95	Yes	Flush Mount	47.1965781	119.2958972
02BW02	1075.30	1075.43	109-118.5	Yes	Flush Mount	47.1827465	119.2954246
02BW01	1038.55	1040.01	188-192.5	Removed	Flush Mount	47.1501845	119.4298267
04-BW01	1084.42	1085.15	96-116	No	Stick Up	47.1967327	119.2956317
04-BW04	1056.98	1057.59	190-210	No	Stick Up	47.1861237	119.3311182
04-BW05	1061.31	1061.74	176-196	No	Stick Up	47.1799661	119.3284913

Table 2. Well ID	Event 3 Elevation (ft)	Event 4 Elevation (ft)	Screened Interval Depth (ft)	Bladder Pump Installed?	Stick Up or Flush Mount	NAD 83 Coordinates	
04-BW06	1064.84	1065.10	174-194	No	Stick Up	47.1784992	119.3162647
04-BW07	1054.90	1055.41	195-215	No	Stick Up	47.1643164	119.3133028
04-BW09	1069.45	1068.75	139-149	No	Flush Mount	47.1652902	119.3032670
04-CW01	1026.78	1034.52	298-308	No	Stick Up	47.1861250	119.3308874
04-CW02	1026.70	1035.11	297-307	No	Stick Up	47.1800362	119.3285468
04-CW03	1019.00	1025.58	264-284	No	Stick Up	47.1802144	119.3116530
04-CW04	1054.95	1056.26	303-313	No	Stick Up	47.1643701	119.3133311
04-CW05	1055.09	1056.44	260-280	No	Stick Up	47.1637312	119.3044163
04-CW07	1021.29	1026.17	283-293	No	Stick Up	47.1551839	119.3091585
			303-309	No			
04-CW08	1019.12	1023.92	294-314	No	Flush Mount	47.1464204	119.3109391
12BW01	1073.38	1073.10	162 - 172	No	Stick Up	47.168105	-119.30197
12BW02	1049.10	1049.32	174 - 194	No	Flush Mount	47.156722	-119.305515
12BW03	1056.44	1056.88	179 - 189	No	Stick Up	47.160178	-119.312552
			199 - 219	No			
12BW04	1068.48	1068.42	158 - 168	No	Stick Up	47.165107	-119.307066
			178 - 188	No			
12BW05	1070.54	1069.66	167 - 187	No	Stick Up	47.162973	-119.303436
12BW06	1054.77	1054.94	170 - 200	No	Flush Mount	47.158675	-119.309105
12BW07	1072.42	1071.81	160 - 180	No	Stick Up	47.164668	-119.303659
12BW08	1050.26	1050.59	178 - 198	No	Flush Mount	47.156733	-119.307692
12CW01	1025.26	1029.43	274 - 294	No	Flush Mount	47.156724	-119.30559
12CW02	1024.56	1031.87	300 - 320	No	Stick Up	47.16022	-119.312575
12CW03	1059.18	1060.48	288-298	No	Stick Up	47.165098	-119.306995
12CW04	1057.85	1058.96	255 - 265	No	Stick Up	47.16294	-119.303394
12CW05	1025.10	1029.86	287 - 307	No	Flush Mount	47.158676	-119.309004
12EX01	1072.17	1071.83	160 - 180	No	Stick Up	47.164649	-119.303577
12EX02	1050.20	1051.55	180 - 198	No	Flush Mount	47.156729	-119.307772
14BW01	1070.00	1166.09	160-180	No	Stick Up	47.163865	-119.305703
14BW02	1059.43	1169.38	157-187	No	Stick Up	47.16211	-119.306087
14BW03	1072.76	1160.28	143-173	No	Stick Up	47.16605	-119.304277
14EX03	1069.17	1166.12	160-180	No	Stick Up	47.163865	-119.305703
14EX04	1059.51	1169.67	157-187	No	Stick Up	47.16211	-119.306087
14EX05	1072.75	1160.18	143-173	No	Stick Up	47.16605	-119.304277

Orange shading indicates two screened intervals requiring two PDBs.

Table 3. Monitoring and Extraction Wells – Sampling Results

Table 3. MONITORING AND EXTRACTION WELL RESULTS				CIS-DCE	TCE
Well ID	Sample Name	Sample Date	Sample Type	Results µg/L (MCL 70 µg/L)	Results µg/L (MCL 5 µg/L)
HANFORD FORMATION AQUIFER WELLS					
00AW11	14MLW0625N00AW11	6/25/2014	N	< 0.20 U	1.05
00AW11	14MLW1004N00AW11	10/4/2014	N	< 0.20 U	1.47
00AW13	14MLW0624N00AW13	6/24/2014	N	< 0.20 U	< 0.20 U
00AW13	14MLW1005N00AW13	10/5/2014	N	< 0.20 U	< 0.20 U
99AW01	14MLW0625N99AW01	6/25/2014	N	< 0.20 U	0.70
99AW01	14MLW1004N99AW01	10/4/2014	N	< 0.20 U	1.10
99AW04	14MLW0627N99AW04	6/27/2014	N	< 0.20 U	< 0.20 U
99AW04	14MLW1005N99AW04	10/5/2014	N	< 0.20 U	< 0.20 U
99AW09	14MLW0626N99AW09	6/26/2014	N	< 0.20 U	1.71
99AW09	14MLW1005N99AW09	10/5/2014	N	< 0.20 U	1.94
PRIEST RAPIDS AND ROZA 1 AQUIFER WELLS					
00BW01	14MLW0623N00BW01	6/23/2014	N	< 0.20 U	< 0.20 U
00BW01	14MLW1001N00BW01	10/1/2014	N	< 0.20 U	< 0.20 U
00BW02	14MLW0624N00BW02	6/24/2014	N	< 0.20 U	0.21
00BW02	14MLW0930N00BW02	9/30/2014	N	< 0.20 U	0.19 J
00BW03	14MLW0624N00BW03	6/24/2014	N	< 0.20 U	< 0.20 U
00BW03	14MLW0930N00BW03	9/30/2014	N	< 0.20 U	< 0.20 U
00BW04	14MLW0623N00BW04	6/23/2014	N	< 0.20 U	< 0.20 U
00BW04	14MLW0623D00BW04	6/23/2014	FD	< 0.20 U	< 0.20 U
00BW05	14MLW0622N00BW05	6/23/2014	N	< 0.20 U	< 0.20 U
00BW05	14MLW0930N00BW05	9/30/2014	N	< 0.20 U	< 0.20 U
00BW05	14MLW0930D00BW05	9/30/2014	FD	< 0.20 U	< 0.20 U
00BW06	14MLW0624N00BW06	6/24/2014	N	< 0.20 U	< 0.20 U
00BW06	14MLW0930N00BW06	9/30/2014	N	< 0.20 U	< 0.20 U
00BW07	14MLW0623N00BW07	6/23/2014	N	< 0.20 U	< 0.20 U
00BW07	14MLW1001N00BW07	10/1/2014	N	< 0.20 U	< 0.20 U
00BW09	14MLW0624N00BW09	6/24/2014	N	< 0.20 U	< 0.20 U
00BW09	14MLW0930N00BW09	9/30/2014	N	< 0.20 U	< 0.20 U
00BW10	14MLW0626N00BW10	6/26/2014	N	< 0.20 U	< 0.20 U
00BW10	14MLW1001N00BW10	10/1/2014	N	< 0.20 U	< 0.20 U
00BW11	14MLW0624N00BW11	6/24/2014	N	< 0.20 U	< 0.20 U
00BW11	14MLW0930N00BW11	9/30/2014	N	< 0.20 U	< 0.20 U
00BW12	14MLW0624N00BW12	6/24/2014	N	< 0.20 U	15.6
00BW12	14MLW0930N00BW12	9/30/2014	N	< 0.20 U	17.0
00BW13	14MLW0622N00BW13	6/22/2014	N	< 0.20 U	0.13 J
00BW13	14MLW1004N00BW13	10/4/2014	N	< 0.20 U	< 0.20 U
00BW14	14MLW0623N00BW14	6/23/2014	N	< 0.20 U	< 0.20 U
00BW14	14MLW1001N00BW14	10/1/2014	N	< 0.20 U	< 0.20 U
00BW15	14MLW0625N00BW15	6/25/2014	N	0.31	1.86
00BW15	14MLW1004N00BW15	10/4/2014	N	0.25	1.74
00BW16	14MLW0624N00BW16	6/24/2014	N	< 0.20 U	< 0.20 U

Table 3. MONITORING AND EXTRACTION WELL RESULTS				CIS-DCE	TCE
Well ID	Sample Name	Sample Date	Sample Type	Results µg/L (MCL 70 µg/L)	Results µg/L (MCL 5 µg/L)
00BW16	14MLW1005N00BW16	10/5/2014	N	< 0.20 U	< 0.20 U
01BW01	14MLW0622N01BW01	6/23/2014	N	< 0.20 U	< 0.20 U
01BW01	14MLW0930N01BW01	9/30/2014	N	< 0.20 U	< 0.20 U
02BW01	14MLW0626N02BW01	6/26/2014	N	< 0.20 U	12.0
02BW01	14MLW0929N02BW01	9/29/2014	N	< 0.20 U	10.8
02BW01	14MLW0929D02BW01	9/29/2014	FD	< 0.20 U	11.2
02BW02	14MLW0623N02BW02	6/23/2014	N	< 0.20 U	< 0.20 U
02BW02	14MLW1001N02BW02	10/1/2014	N	< 0.20 U	< 0.20 U
04BW01	14MLW062204BW01	6/22/2014	N	< 0.20 U	< 0.20 U
04BW01	14MLW0928N04BW01	9/28/2014	N	< 0.20 U	< 0.20 U
04BW04	14MLW0622N04BW04	6/22/2014	N	< 0.20 U	0.45
04BW04	14MLW0928N04BW04	9/28/2014	N	< 0.20 U	0.45
04BW05	14MLW0622N04BW05	6/22/2014	N	< 0.20 U	1.70
04BW05	14MLW0928N04BW05	9/28/2014	N	< 0.20 U	1.44
04BW06	14MLW0622N04BW06	6/22/2014	N	2.77	12.7
04BW06	14MLW0928N04BW06	9/28/2014	N	2.64	11.4
04BW07	14MLW0622N04BW07	6/22/2014	N	< 0.20 U	< 0.20 U
04BW07	14MLW0929N04BW07	9/29/2014	N	< 0.20 U	< 0.20 U
04BW09	14MLW0622N04BW09	6/22/2014	N	< 0.20 U	25.1
04BW09	14MLW0929N04BW09	9/29/2014	N	< 0.20 U	27.5
12BW01	14MLW0622N12BW01	6/22/2014	N	< 0.20 U	< 0.20 U
12BW01	14MLW0929N12BW01	9/29/2014	N	< 0.20 U	< 0.20 U
12BW02	14MLW0627N12BW02	6/27/2014	N	< 0.20 U	6.88 J+
12BW02	14MLW0627D12BW02	6/27/2014	FD	< 0.20 U	8.55
12BW02	14MLW0929N12BW02	9/29/2014	N	< 0.20 U	7.72
12BW03	14MLW0627N12BW03A	6/27/2014	N	< 0.20 U	0.94
12BW03	14MLW0627N12BW03B	6/27/2014	N	< 0.20 U	0.88
12BW03	14MLW0929N12BW03A	9/29/2014	N	< 0.20 U	0.90
12BW03	14MLW0929D12BW03A	9/29/2014	FD	< 0.20 U	0.75
12BW03	14MLW0929N12BW03B	9/29/2014	N	< 0.20 U	0.59
12BW04	14MLW0622N12BW04A	6/22/2014	N	< 0.20 U	17.4
12BW04	14MLW0622N12BW04B	6/22/2014	N	< 0.20 U	17.5
12BW04	14MLW0929N12BW04A	9/29/2014	N	< 0.20 U	18.8
12BW04	14MLW0929N12BW04B	9/29/2014	N	< 0.20 U	17.8
12BW05	14MLW0622N12BW05	6/22/2014	N	< 0.20 U	88.2 J-
12BW05	14MLW0929N12BW05	9/29/2014	N	< 0.20 U	87.2
12BW06	14MLW0627N12BW06	6/27/2014	N	< 0.20 U	5.96
12BW06	14MLW0929N12BW06	9/29/2014	N	< 0.20 U	5.08
12BW07	14MLW0622N12BW07	6/22/2014	N	< 0.20 U	60.1 J-
12BW07	14MLW0929N12BW07	9/29/2014	N	< 0.20 U	64.6
12BW08	14MLW0627N12BW08	6/27/2014	N	< 0.20 U	9.56
12BW08	14MLW0929N12BW08	9/29/2014	N	< 0.20 U	8.28
14BW01	14MLW0626N14BW01	6/26/2014	N	< 0.20 U	46.2
14BW01	14MLW0929N14BW01	9/29/2014	N	< 0.20 U	47.2
14BW02	14MLW0626N14BW02	6/26/2014	N	< 0.20 U	20.5
14BW02	14MLW0929N14BW02	9/29/2014	N	< 0.20 U	18.3

Table 3. MONITORING AND EXTRACTION WELL RESULTS				CIS-DCE	TCE
Well ID	Sample Name	Sample Date	Sample Type	Results µg/L (MCL 70 µg/L)	Results µg/L (MCL 5 µg/L)
14BW03	14MLW0622N14BW03	6/22/2014	N	< 0.20 U	12.2
14BW03	14MLW0929N14BW03	9/29/2014	N	< 0.20 U	10.8
91BW02	14MLW0624N91BW02	6/24/2014	N	< 0.20 U	< 0.20 U
91BW02	14MLW0624D91BW02	6/24/2014	FD	< 0.20 U	< 0.20 U
91BW02	14MLW0930N91BW02	9/30/2014	N	< 0.20 U	< 0.20 U
91BW03	14MLW0625N91BW03	6/25/2014	N	< 0.20 U	31.0
91BW03	14MLW0625D91BW03	6/25/2014	FD	< 0.20 U	30.3
91BW03	14MLW1004N91BW03	10/4/2014	N	< 0.20 U	32.3
91BW04	14MLW0625N91BW04	6/25/2014	N	< 0.20 U	0.21
91BW04	14MLW1004N91BW04	10/4/2014	N	< 0.20 U	0.18 J
91BW04	14MLW1004D91BW04	10/4/2014	FD	< 0.20 U	0.19 J
92BW01	14MLW0625N92BW01	6/25/2014	N	< 0.20 U	17.8
92BW01	14MLW1004N92BW01	10/4/2014	N	< 0.20 U	21.2
92BW02	14MLW0625N92BW02	6/25/2014	N	0.70	6.69
92BW02	14MLW1004N92BW02	10/4/2014	N	0.86	7.70
99BW01	14MLW0625N99BW01	6/25/2014	N	< 0.20 U	32.6
99BW01	14MLW1004N99BW01	10/4/2014	N	< 0.20 U	32.2
99BW09	14MLW0626N99BW09	6/26/2014	N	< 0.20 U	< 0.20 U
99BW09	14MLW1001N99BW09	10/1/2014	N	< 0.20 U	< 0.20 U
99BW10	14MLW0626N99BW10	6/26/2014	N	< 0.20 U	12.8
99BW10	14MLW0626D99BW10	6/26/2014	FD	< 0.20 U	12.8
99BW10	14MLW1005N99BW10	10/5/2014	N	< 0.20 U	12.6
99BW11	14MLW0627N99BW11	6/27/2014	N	< 0.20 U	< 0.20 U
99BW11	14MLW1005N99BW11	10/5/2014	N	< 0.20 U	< 0.20 U
99BW12	14MLW0624N99BW12	6/24/2014	N	< 0.20 U	0.28
99BW12	14MLW1001N99BW12	10/1/2014	N	< 0.20 U	0.29
99BW12	14MLW1005N99BW12	10/5/2014	N	< 0.20 U	0.38
99BW12	14MLW1005D99BW12	10/5/2014	FD	< 0.20 U	0.32
99BW14	14MLW0625N99BW14	6/25/2014	N	< 0.20 U	< 0.20 U
99BW14	14MLW1001N99BW14	10/1/2014	N	< 0.20 U	< 0.20 U
99BW15	14MLW0623N99BW15	6/23/2014	N	1.58	6.75
99BW15	14MLW1001N99BW15	10/1/2014	N	1.62	6.77
99BW16	14MLW0623N99BW16	6/23/2014	N	< 0.20 U	1.65
99BW16	14MLW1003N99BW16	10/3/2014	N	< 0.20 U	1.84
99BW18	14MLW0626N99BW18	6/26/2014	N	< 0.20 U	7.19
99BW18	14MLW1005N99BW18	10/5/2014	N	< 0.20 U	8.28
ROZA 2 AQUIFER WELLS					
04CW01	14MLW0622N04CW01	6/22/2014	N	< 0.20 U	0.48
04CW01	14MLW0622D04CW01	6/22/2014	FD	< 0.20 U	0.46
04CW01	14MLW0928N04CW01	9/28/2014	N	< 0.20 U	0.62
04CW02	14MLW0622N04CW02	6/22/2014	N	< 0.20 U	< 0.20 U
04CW02	14MLW0928N04CW02	9/28/2014	N	< 0.20 U	< 0.20 U
04CW03	14MLW0622N04CW03	6/22/2014	N	< 0.20 U	2.47
04CW03	14MLW0928N04CW03	9/28/2014	N	< 0.20 U	2.51
04CW04	14MLW0622N04CW04	6/22/2014	N	< 0.20 U	0.43

Table 3. MONITORING AND EXTRACTION WELL RESULTS				CIS-DCE	TCE
Well ID	Sample Name	Sample Date	Sample Type	Results µg/L (MCL 70 µg/L)	Results µg/L (MCL 5 µg/L)
04CW04	14MLW0929N04CW04	9/29/2014	N	< 0.20 U	0.41
04CW05	14MLW0627N04CW05	6/27/2014	N	< 0.20 U	2.77
04CW05	14MLW0929N04CW05	9/29/2014	N	< 0.20 U	2.69
04CW07	14MLW0626N04CW07A	6/26/2014	N	< 0.20 U	4.83
04CW07	14MLW0626N04CW07B	6/26/2014	N	< 0.20 U	5.73
04CW07	14MLW0929N04CW07A	9/29/2014	N	< 0.20 U	5.22
04CW07	14MLW0929N04CW07B	9/29/2014	N	< 0.20 U	5.60
04CW08	14MLW0622N04CW08	6/22/2014	N	< 0.20 U	< 0.20 U
04CW08	14MLW0929N04CW08	9/29/2014	N	< 0.20 U	< 0.20 U
12CW01	14MLW0627N12CW01	6/27/2014	N	< 0.20 U	3.54
12CW01	14MLW0627D12CW01	6/27/2014	FD	< 0.20 U	3.52
12CW01	14MLW0929N12CW01	9/29/2014	N	< 0.20 U	3.26
12CW02	14MLW0627N12CW02	6/27/2014	N	< 0.20 U	0.11 J
12CW02	14MLW0929N12CW02	9/29/2014	N	< 0.20 U	0.29
12CW03	14MLW0622N12CW03	6/22/2014	N	< 0.20 U	0.32
12CW03	14MLW0929N12CW03	9/29/2014	N	< 0.20 U	0.30
12CW04	14MLW0622N12CW04	6/22/2014	N	< 0.20 U	0.51
12CW04	14MLW0929N12CW04	9/29/2014	N	< 0.20 U	0.70
12CW05	14MLW0627N12CW05	6/27/2014	N	< 0.20 U	0.93
12CW05	14MLW0929N12CW05	9/29/2014	N	< 0.20 U	0.67
EXTRACTION WELLS					
12EX01	14MLW0622N12EX01	6/22/2014	N	0.59	4.65
12EX01	14MLW0929N12EX01	9/29/2014	N	0.45	3.45
12EX02	14MLW0627N12EX02	6/27/2014	N	< 0.20 U	5.03
12EX02	14MLW0929N12EX02	9/29/2014	N	< 0.20 U	4.24
14EX03	14MLW0626N14EX03	6/26/2014	N	< 0.20 U	45.0
14EX03	14MLW0929N14EX03	9/29/2014	N	0.20	39.1
14EX04	14MLW0626N14EX04	6/26/2014	N	< 0.20 U	13.4
14EX04	14MLW0626D14EX04	6/26/2014	FD	< 0.20 U	14.1
14EX04	14MLW0929N14EX04	9/29/2014	N	< 0.20 U	17.8
14EX05	14MLW0622N14EX05	6/22/2014	N	< 0.20 U	5.98
14EX05	14MLW0929N14EX05	9/29/2014	N	< 0.20 U	5.47
14EX05	14MLW0929D14EX05	9/29/2014	FD	< 0.20 U	5.53

Well shaded red exceeded the 5.0 µg/L TCE MCL.

MCL = Maximum Contaminant Level
FD = field duplicate
FB = field blank
EB = equipment blank

N = normal sample
U = undetected
J = estimated
J- = estimated, biased low

Table 4. Private Wells without WHFs – Sampling Results

Table 4. PRIVATE WELL WITHOUT WHF - RESULTS				CIS-DCE	TCE
Well ID	Sample Name	Sample Date	Sample Type	Results µg/L (MCL 70 µg/L)	Results µg/L (MCL 5 µg/L)
WP-03	14MLW0626DWP03	6/26/2014	FD	0.31	1.16
WP-03	14MLW0626NWP03	6/26/2014	N	0.24	1.09
WP-04	14MLW0626NWP04	6/26/2014	N	1.52	4.83
WP-04	14MLW1002DWP04	10/2/2014	FD	1.56	4.32
WP-04	14MLW1002NWP04	10/2/2014	N	1.40	4.89
WP-09	14MLW0624NWP09	6/24/2014	N	< 0.20 U	< 0.20 U
WP-10	14MLW0626NWP10	6/26/2014	N	< 0.20 U	< 0.20 U
WP-105	14MLW0625NWP105	6/25/2014	N	< 0.20 U	0.35
WP-111	14MLW0625NWP111	6/25/2014	N	< 0.20 U	0.30
WP-116	14MLW0623DWP116	6/23/2014	FD	0.36	1.53
WP-116	14MLW0623NWP116	6/23/2014	N	0.40	1.70
WP-118	14MLW0623NWP118	6/23/2014	N	< 0.20 U	1.24
WP-120	14MLW0625NWP120	6/25/2014	N	< 0.20 U	0.42
WP-122	14MLW0625NWP122	6/25/2014	N	< 0.20 U	0.54
WP-125	14MLW001WP125	11/19/2013	N	0.72	3.48
WP-125	14MLW002WP125	2/20/2014	N	0.70	3.44
WP-125	14MLW0623NWP125	6/23/2014	N	0.62	3.12
WP-125	14MLW1002NWP125	10/2/2014	N	0.68	3.42
WP-126	14MLW0623NWP126	6/23/2014	N	0.23	1.06
WP-127	14MLW0625DWP127	6/25/2014	FD	< 0.20 U	0.70
WP-127	14MLW0625NWP127	6/25/2014	N	< 0.20 U	0.72
WP-128	14MLW0625NWP128	6/25/2014	N	< 0.20 U	0.26
WP-130	14MLW0625NWP130	6/25/2014	N	< 0.20 U	0.17 J
WP-131	14MLW001WP131	11/19/2013	N	< 0.20 U	0.88
WP-131	14MLW002WP131	2/20/2014	N	< 0.20 U	0.80
WP-131	14MLW0625NWP131	6/25/2014	N	< 0.20 U	2.42
WP-131	14MLW1003NWP131	10/3/2014	N	< 0.20 U	1.95
WP-136	14MLW0626NWP136	6/26/2014	N	< 0.20 U	1.38
WP-138	14MLW0626NWP138	6/26/2014	N	< 0.20 U	0.24
WP-139	14MLW0626NWP139	6/26/2014	N	< 0.20 U	0.77
WP-13E	14MLW0624NWP13E	6/24/2014	N	< 0.20 U	< 0.20 U
WP-143	14MLW0626NWP143	6/26/2014	N	< 0.20 U	0.67
WP-144	14MLW0626NWP144	6/26/2014	N	< 0.20 U	0.38
WP-145	14MLW0626DWP145	6/26/2014	FD	< 0.20 U	0.35
WP-145	14MLW0626NWP145	6/26/2014	N	< 0.20 U	0.34
WP-147	14MLW0625NWP147	6/25/2014	N	< 0.20 U	0.20
WP-148	14MLW0625NWP148	6/25/2014	N	< 0.20 U	0.16 J
WP-149	14MLW0625NWP149	6/25/2014	N	< 0.20 U	< 0.20 U
WP-150	14MLW0625NWP150	6/25/2014	N	< 0.20 U	< 0.20 U
WP-151	14MLW0625NWP151	6/25/2014	N	0.16 J	1.50
WP-152	14MLW0626NWP152	6/26/2014	N	< 0.20 U	0.21

Table 4. PRIVATE WELL WITHOUT WHF - RESULTS				CIS-DCE	TCE
Well ID	Sample Name	Sample Date	Sample Type	Results µg/L (MCL 70 µg/L)	Results µg/L (MCL 5 µg/L)
WP-153	14MLW0626NWP153	6/26/2014	N	< 0.20 U	0.36
WP-154	14MLW0626NWP154	6/26/2014	N	< 0.20 U	0.33
WP-155	14MLW0626NWP155	6/26/2014	N	< 0.20 U	0.26
WP-156	14MLW0623DWP156	6/23/2014	FD	< 0.20 U	0.58
WP-156	14MLW0623NWP156	6/23/2014	N	< 0.20 U	0.57
WP-164	14MLW0624NWP164	6/24/2014	N	< 0.20 U	0.33
WP-165	14MLW0626NWP165	6/26/2014	N	< 0.20 U	< 0.20 U
WP-167	14MLW001WP167	11/19/2013	N	< 0.20 U	2.29
WP-167	14MLW002WP167	2/21/2014	N	< 0.20 U	1.22
WP-167	14MLW0624NWP167	6/24/2014	N	< 0.20 U	2.53
WP-167	14MLW1003NWP167	10/3/2014	N	< 0.20 U	2.30
WP-168	14MLW001WP168	11/19/2013	N	< 0.20 U	3.32
WP-168	14MLW002WP168	2/21/2014	N	< 0.20 U	2.12
WP-168	14MLW0624NWP168	6/24/2014	N	< 0.20 U	2.32
WP-168	14MLW1003NWP168	10/3/2014	N	< 0.20 U	2.78
WP-169	14MLW0624NWP169	6/24/2014	N	< 0.20 U	1.95
WP-172	14MLW0625NWP172	6/25/2014	N	< 0.20 U	0.59
WP-175	14MLW0624NWP175	6/24/2014	N	< 0.20 U	0.38
WP-177	14MLW0624NWP177	6/24/2014	N	< 0.20 U	< 0.20 U
WP-178	14MLW0623NWP178	6/23/2014	N	< 0.20 U	0.27
WP-179	14MLW0625DWP179	6/25/2014	FD	< 0.20 U	< 0.20 U
WP-179	14MLW0625NWP179	6/25/2014	N	< 0.20 U	< 0.20 U
WP-180	14MLW0626NWP180	6/26/2014	N	< 0.20 U	< 0.20 U
WP-18N	14MLW0624NWP18N	6/24/2014	N	< 0.20 U	0.27
WP-18S	14MLW0624NWP18S	6/24/2014	N	< 0.20 U	0.20
WP-25W	14MLW0623NWP25W	6/23/2014	N	< 0.20 U	0.86
WP-27	14MLW001WP27	11/18/2013	N	< 0.20 U	< 0.20 U
WP-27	14MLW002WP27	2/19/2014	N	< 0.20 U	1.22
WP-27	14MLW0623NWP27	6/23/2014	N	< 0.20 U	1.39
WP-27	14MLW1002NWP27	10/2/2014	N	< 0.20 U	1.33
WP-28	14MLW0623DWP28	6/23/2014	FD	< 0.20 U	1.13
WP-28	14MLW0623NWP28	6/23/2014	N	< 0.20 U	1.19
WP-33	14MLW0625NWP33	6/25/2014	N	< 0.20 U	0.79
WP-45	14MLW0624NWP45	6/24/2014	N	< 0.20 U	0.92
WP-50	14MLW0623NWP50	6/23/2014	N	< 0.20 U	< 0.20 U
WP-52	14MLW0624NWP52	6/24/2014	N	< 0.20 U	0.28
WP-54	14MLW0624NWP54	6/24/2014	N	< 0.20 U	< 0.20 U
WP-57	14MLW0626NWP57	6/26/2014	N	< 0.20 U	0.55
WP-65	14MLW0625NWP65	6/25/2014	N	< 0.20 U	0.43
WP-66	14MLW0623NWP66	6/23/2014	N	0.30	1.31
WP-68	14MLW0626NWP68	6/26/2014	N	< 0.20 U	0.43
WP-69	14MLW0626DWP69	6/26/2014	FD	< 0.20 U	1.47
WP-69	14MLW0626NWP69	6/26/2014	N	< 0.20 U	1.33

Table 4. PRIVATE WELL WITHOUT WHF - RESULTS				CIS-DCE	TCE
Well ID	Sample Name	Sample Date	Sample Type	Results µg/L (MCL 70 µg/L)	Results µg/L (MCL 5 µg/L)
WP-71A	14MLW0626NWP71A	6/26/2014	N	< 0.20 U	0.17 J
WP-71B	14MLW0624NWP71B	6/24/2014	N	< 0.20 U	0.44
WP-74	14MLW0624NWP74	6/24/2014	N	< 0.20 U	1.23
WP-82	14MLW0623NWP82	6/23/2014	N	< 0.20 U	< 0.20 U
	Well shaded yellow exceeded 2.0 µg/L TCE in 2013 and was sampled quarterly in 2014.				
	Well shaded orange exceeded 3.5 µg/L TCE in 2013 and was sampled quarterly in 2014. This well does not have a WHF system because the water is used for industrial purposes only.				

MCL = Maximum Contaminant Level
N = normal sample
FD = field duplicate
FB = field blank
EB = equipment blank
U = undetected
J = estimated
J- = estimated, biased low

Table 5. Private Wells with WHFs –Sampling Results

NOTE: Effluent results in all cases were < 0.20 µg/L for cis-DCE and TCE and therefore are not shown

PRIVATE WHF WELL RESULTS					CIS-DCE	TCE
Well ID	Sample Name[1]	Sample Date	Sample Type	Sample Location[2]	Results µg/L (MCL 70 µg/L)	Results µg/L (MCL 5 µg/L)
WP-119	14MLW01AWP119	11/19/2013	N	Influent	< 0.20 U	3.99
WP-119	14MLW02AWP119	2/20/2014	N	Influent	< 0.20 U	3.95
WP-119	14MLW0624NWP119A	6/24/2014	N	Influent	< 0.20 U	4.25
WP-121	14MLW01AWP121	11/19/2013	N	Influent	< 0.20 U	4.02
WP-121	14MLW02AWP121	2/20/2014	N	Influent	< 0.20 U	3.47
WP-121	14MLW0624NWP121A1	6/24/2014	N	Influent	< 0.20 U	4.89
WP-121	14MLW1002NWP121A1	10/2/2014	N	Influent	< 0.20 U	4.67
WP-123	14MLW001WP123	11/19/2013	N	No WHF	0.29	2.81
WP-123	14MLW201WP123	11/19/2013	FD	No WHF	0.25	2.76
WP-123	14MLW002WP123	2/20/2014	N	No WHF	0.34	2.28
WP-123	14MLW202WP123	2/20/2014	FD	No WHF	0.33	2.19
WP-123	14MLW0623NWP123	6/23/2014	N	No WHF	0.15 J	3.82
WP-123	14MLW1002NWP123A1	10/2/2014	N	Influent	0.18 J	3.71
WP-124	14MLW01AWP124	11/19/2013	N	Influent	0.95	4.32
WP-124	14MLW02AWP124	2/20/2014	N	Influent	0.86	3.72
WP-124	14MLW1002NWP124A1	10/2/2014	N	Influent	0.77	3.48
WP-129	14MLW01AWP129	11/19/2013	N	Influent	< 0.20 U	2.99
WP-129	14MLW02AWP129	2/21/2014	N	Influent	< 0.20 U	2.76
WP-129	14MLW0625NWP129A1	6/25/2014	N	Influent	< 0.20 U	2.11
WP-129	14MLW1002NWP129A1	10/2/2014	N	Influent	< 0.20 U	1.41
WP-14	14MLW01AWP14	11/18/2013	N	Influent	0.87	3.89
WP-14	14MLW02AWP14	2/19/2014	N	Influent	0.92	3.75
WP-14	14MLW0519NWP14A1	5/19/2014	N	Influent	1.06	3.89
WP-14	14MLW1003NWP14A1	10/3/2014	N	Influent	1.03	3.81
WP-70	14MLW01AWP70	11/19/2013	N	Influent	0.18 J	3.83
WP-70	14MLW02AWP70	2/20/2014	N	Influent	0.20	3.58
WP-70	14MLW0519NWP70A1	5/19/2014	N	Influent	0.23	2.81
WP-70	14MLW1002NWP70A2	10/2/2014	N	Influent	0.19 J	4.11
WP-70	14MLW1002DWP70A2	10/2/2014	FD	Influent	0.22	4.35
WP-83	14MLW01AWP83	11/18/2013	N	Influent	0.29	1.57
WP-83	14MLW02AWP83	2/19/2014	N	Influent	0.29	1.34
WP-83	14MLW0519NWP83A1	5/19/2014	N	Influent	0.23	1.94
WP-83	14MLW0519NWP83B1	5/19/2014	N	Mid	0.17 J	< 0.20 U
WP-83	14MLW1003NWP83A1	10/3/2014	N	Influent	0.30	1.07
WP-86	14MLW01AWP86	11/18/2013	N	Influent	< 0.20 U	2.64
WP-86	14MLW02AWP86	2/19/2014	N	Influent	< 0.20 U	3.17
WP-86	14MLW0519NWP86A1	5/19/2014	N	Influent	< 0.20 U	1.35
WP-86	14MLW1003NWP86A1	10/3/2014	N	Influent	< 0.20 U	2.02

1 - Sample names without an A, B, or C indicate wells where a WHF had not yet been installed.

2 - Sample Locations are as follows: Influent to WHF system before lead filter ("A"); In between lead and lag filter (mid, "B"); Effluent after lag filter ("C" [not shown]).

MCL -Maximum Contaminant Level; N - Normal Sample; FD - Field Duplicate; U - Undetected; J - Estimated

Table 6. Whole House Filters – Purge and Totalizer Volume Summary

Date	Well System	Flow Meter Initial (Gal)	Flow Meter Final (Gal)
November 2013 - Event 1			
11/18/2013	WP-70	41,606	41,635
11/18/2013	WP-86	153,315	153,317
11/18/2013	WP-83	704,407	704,419
11/18/2013	WP-14	34,290	34,907
11/19/2013	WP-119		
11/19/2013	WP-121		
11/19/2013	WP-124		
11/19/2013	WP-129		
February 2014 – Event 2			
2/19/2014	WP-70	72,180	72,191
2/19/2014	WP-86	173,561	173,570
2/19/2014	WP-83	755,668	755,670
2/19/2014	WP-14	39,550	39,553
2/20/2014	WP-119	64,077	64,094
2/20/2014	WP-121	10,299	10,299
2/20/2014	WP-124	51,202	51,229
2/21/2014	WP-129	11,227	11,233
May/June 2014 - Event 3			
5/19/2014	WP-70	91,578	91,583
5/19/2014	WP-86	205,805	205,811
5/19/2014	WP-83	906,185	906,258
5/19/2014	WP-14	481,894	481,970
6/24/2014	WP-119	Not recorded	
6/24/2014	WP-121	10,299	10,299
6/23/2014	WP-124	Not recorded	
6/25/2014	WP-129	27,072	27,091
September/October 2014 – Event 4			
10/2/2014	WP-70	121,263	121,277
10/3/2014	WP-86	319,913	319,929
10/3/2014	WP-83	1,215,037	1,215,064
10/3/2014	WP-14	781,121	781,149
10/2/2014	WP-119*	162,093	162,093
10/2/2014	WP-121	10,299	10,299
10/2/2014	WP-123	6,399	6,425
10/2/2014	WP-124	134,686	134,705
10/2/2014	WP-129	28,839	28,843

* power turned off

Orange shading indicates improperly working flow meter – was replaced 1/14/15 and restarted at 0.00.

APPENDIX A - Field Sampling Reports

APPENDIX A
FIELD SAMPLING REPORTS

1. **November 2013**
2. **February 2014**
3. **May/June 2014**
4. **September/October 2014**

November 2013 Field Sampling Report

Private Wells
Groundwater Sampling Field Report
November 2013 Field Sampling Event

Moses Lake Wellfield Superfund Site
Moses Lake, Washington

Field Investigation:
18-19 November 2013
Report Prepared:
January 2014

By: Technical Services Branch

US Army Corps of Engineers ®
Seattle District

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<u>APPENDICES</u>

1.0 BACKGROUND AND OBJECTIVE OF INVESTIGATION

1.1 BACKGROUND

The Moses Lake Wellfield Superfund Site is located between the Grant County Airport and the City of Moses Lake, Washington. The Site includes the former Larson Air Force Base (LAFB) property, Port of Moses Lake property and adjacent private properties affected by Site groundwater contamination. The Site is listed on the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980 National Priorities List (NPL) for Uncontrolled Hazardous Waste Sites.

The Moses Lake Wellfield Superfund Site is an area of approximately 15 square miles, which includes the former LAFB, commercial facilities, and residences. The former LAFB occupied approximately 9,607 acres three miles northwest of the City of Moses Lake. The United States Air Force was active at the site from 1942 until 1966. During 1988 and 1989, the Washington State Department of Health confirmed the presence of trichloroethylene (TCE) above the Federal Maximum Contaminant Level (MCL) in three City of Moses Lake municipal wells and two Skyline community wells. The Seattle District, US Army Corps of Engineers (USACE) completed a Remedial Investigation (RI) phase in 2003. Appendix A of this report shows the general location map and a site map with current sampling locations.

During the course of the RI, several private wells were tested and found to be contaminated with TCE. In 2001, the USACE contracted installation of carbon filtration units – known as whole house filter systems (WHF) - at five of those wells. Several years of groundwater monitoring data has been evaluated since the original WHF systems were installed.

The final results of the Phase I RI released in a report in March 1993 indicated that TCE was consistently found in shallow alluvial and upper basalt (*a*-basalt) groundwater in the central area of the former base.

On October 14, 1992, the affected areas of the former LAFB and off-site down gradient areas, termed the "Moses Lake Wellfield Contamination", were listed on the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) of 1980 for Uncontrolled Hazardous Waste Sites. The former LAFB property is one part of the Moses Lake Wellfield Superfund Site; the site also includes the contaminant plume.

Chemical results from 1993 and 1994 combined with historical data indicated that TCE occurred in the central and southern portion of the former LAFB in alluvial and *a*-basalt groundwater. In 2004, USACE confirmed TCE contamination in the next lower basalt aquifer (c-basalt). As of 1995, the data suggest that more than one source may have contributed TCE to the alluvial and *a*-basalt groundwater in the central portion of the former LAFB.

In 1998, URS Greiner completed a sampling round of private water wells and wells for Class A and Class B water systems east, south and southwest of the previously known TCE plume. There were eight detections of TCE during this study. Four wells that were previously outside the plume extent were found to be above the detection limit.

1.2 Groundwater Sampling Event Summary and Objectives

In coordination with the US Environmental Protection Agency (USEPA) Region 10, the USACE environmental field team comprised of Joseph Marsh and David Sullivan deployed to conduct the November 2013 Moses Lake Wellfield groundwater sampling event. The activities described in this report involves the USACE field team verifying sample point locations; discussion of sampling techniques; recording groundwater observations; collection of groundwater samples; and shipping those samples by overnight delivery for laboratory analysis.

All of the work described in this report was accomplished in accordance with the Moses Lake Wellfield Superfund Site Quality Assurance Project Plan. In addition, the team followed the guidance presented in: the Seattle District, USACE Safety and Health Plan; USACE Safety Manual EM 385-1-1; and Seattle District, USACE, Sampling Standard Operating Procedures (SOP) for environmental field sampling.

The private wells and monitoring wells designated for sampling are displayed on maps found at Appendix A. These wells have been selected based on their down-gradient locations relative to the inferred flow direction of TCE-contaminated groundwater and validated sampling analytical data from previous monitoring events.

The November 2014 sampling event included groundwater sample collection from six private wells, and eight WHF systems. Groundwater samples were not collected from monitoring wells during this event. The sampling event was conducted on 18 and 19 November, 2013.

The objectives of groundwater sampling at Moses Lake are to: 1) collect representative samples from designated private well systems and monitoring wells yielding data of known and sufficient quality to evaluate TCE concentrations and define existing TCE plumes; 2) to assure compliance with the requirements of USEPA; and 3) to make critical project - specific decisions based on the evaluated data.

2.0 DESCRIPTION OF WORK

2.1 Activities Prior to the November 2013Groundwater Sampling Event

The USACE project team worked to collect signatures on Department of the Army Right of Entry forms as required before conducting the well sampling on private, city or county government property. For most properties, previously signed Right of Entry forms were still valid. For all properties designated for sample collection, owners (and renters if applicable) were contacted to coordinate sample collection times during the scheduled field sampling week. Many of the owners allowed the field team to work on their property while they were not at home. At some of the properties, home owners or well system managers had to unlock pump houses and open valves for the team – requiring prior coordination.

Prior to conducting sampling activities at each location, the team verified the address or well location and map location matched, and that the Right of Entry form had been signed prior to arriving at each sampling location.

The field team was responsible for identifying potential health and safety hazards at each sampling location. If a hazard is verified at a private well sampling location, an alternate hose bib connected to the same water source may be selected in a safer area of the subject property. In the case of hazardous monitoring well conditions, rescheduling the collection time or date when the hazards no longer exist may be required.

Also for private well sampling, the field team was tasked with determining the most appropriate cold-water tap or other sample port as close to each wellhead as practical, while comparing notes on sample points collected during previous sampling events. The team was briefed that groundwater samples would not be collected from taps delivering chlorinated, aerated, softened or filtered water.

2.2 Private Well Sampling Procedures

Per established standard operating procedure, private well purging flow rate has been set at approximately one gallon per minute (3.8 liters) maximum as verified by graduated cylinder or other suitable water measurement container. During flow rate adjustments, the team monitored the surrounding area and flowing water for unusual observations and odors as purge water is captured in a five gallon purge water bucket. They recorded the start time of the 15 minute purging in the field logbook immediately after opening each hose bib sample point.

After recording brief observations at each private well from the opened sample point hose bib valve, the sample point valve was temporarily closed to allow connection of the flow cell inlet tubing assembly.

The flow cell inlet port was connected to the designated sample point (hose bib) using a specialized “Tee” tubing assembly allowing well water to flow directly into the five gallon purge water bucket at a high flow rate while allowing well water to be conveyed directly to the flow cell at a lower flow rate as required to prevent instrument damage. The sample point hose bib and flow control valve on the tubing assembly was slowly opened to a maximum measured flow rate not to exceed 500 ml/min. to avoid damaging the sensitive flow cell probes with excessive water pressure. Once that was achieved, the flow rate at the bypass tubing was measured and recorded in the field book along with the official purging start time. As the water was observed flowing through the flow cell system and out into the purge bucket, flow cell measurements would be recorded in the project field book every two minutes until the water quality parameters stabilized. Stabilization parameter requirements for all private wells and WHF systems are as follows:

Temperature	+/- 0.2 ºC
Specific Conductivity	+/- 0.020 millisiemens/centimeter (mS/cm)
DO	+/- 0.2 milligrams/liter (mg/l)
pH	+/- 0.2 units
ORP	+/- 20 millivolts (mV)

If stabilization occurred before the 15 minute total required purge time (as it did at every well), final stabilized measurements were recorded in the field book, and purging continued until 15 minutes total purge time had elapsed. At that time, the flow cell was powered down and the associated flow cell inlet tubing disconnected from the flow cell. Purged water continued to be captured in a five-gallon bucket through the bypass tubing at a rate of approximately one gpm.

After 15 minutes has elapsed, the sample point hose bib was shut off, and the tubing assembly removed to permit sampling directly from the hose bib. The approximate total purged volume and stabilized water quality readings were recorded in the project field book along with any other significant observations. The team then conducted the sample collection activities.

Prior to collecting a water sample, the team reduced the flow rate at each tap to approximately 150 to 200 ml/min. to minimize sample water turbulence and aeration. Prior to sample collection at each private well system, the samplers donned protective eyewear and new, clean, Nitrile gloves to prevent exposure to contaminants and cross-contamination. All groundwater samples were collected in pre-cleaned certified containers obtained from the analytical laboratory.

All sample containers were filled with water directly from each tap – forming a meniscus at the top of each vial to provide zero headspace samples as required. Sample point location and components of each plumbing system were noted to assist in data interpretation.

A photographic record of each sample point was made by the team. In addition, handle tags (indicating that water samples were taken by USACE on that date and time) are placed on the front doors of homes sampled if nobody was home during sample collection. A photo was taken of the handle tag and front of house in that case for the project files.

After the sample containers are filled, sample labels describing project, location, analysis, team members, preservative, sampling date, and collection time are placed on the containers. The samples are then packaged in bubble wrap bags and plastic zipper type bags, placed into pre-iced sample shipping coolers and prepared for shipment as described in Section 3.0. All personnel worked to ensure each property was left just as they found it with no damage done, and any doors or gates closed as required.

2.3 Whole House Filter Sampling Procedures

In coordination with USEPA and affected Moses Lake area homeowners, granular activated carbon (GAC) water filters have been installed in private well systems showing TCE results of 3.5 µg/l or greater. Each GAC filter system consists of two lightweight composite GAC filter tanks (acting as lead and lag filters), associated piping, bag filters (to prevent GAC particles from entering the household plumbing system), pressure gauges and valved/regulated sample collection ports.

Each system was purged according to the current private well sampling SOP described in Section 2.2 of this report. A hose bib nearest the well head was opened and a flow rate of approximately one gallon per minute (gpm) established as measured with graduated cylinder. The purged water was captured in a five gallon bucket and simultaneously directed into a flow cell to facilitate the collection of water quality parameter data consisting of temperature, specific conductivity, dissolved oxygen, pH, oxygen reduction potential, and turbidity. Once stabilization of these water quality parameters was achieved, the final readings were recorded and purging continued until 15 minutes had elapsed. The hose bib was closed and sampling commenced after 15 minutes of purging was completed at each location.

WHF sampling ports consist of three locations labeled “A” for the lead inlet port, “B” for the lead filter outlet port, and “C” for the lag filter outlet port.

WHF sample collection consists of opening each designated sample port valve fully to allow the maximum restricted flow rate of approximately 150 to 200 ml/min to flow into a capture bucket for a few seconds to ensure organic matter or air bubbles have been flushed out of the system. Restrictors have been placed on the sampling lines to provide a smooth, non-turbulent stream at a low-flow rate to minimize loss of volatiles that may be present in the water stream. Next, the field team immediately filled three pre-preserved VOA vials to zero headspace. New Nitrile gloves were donned before collecting samples at each port. All discharged water was directed into a five gallon plastic bucket for transfer to ground surface away from the shed or pump house GAC filter location after the samples were collected.

2.4 Sampling Event Activities and Observations

2.4.1 Private Well and WHF System Sampling

During the November 2013 groundwater sampling event, samples were collected from a total of 14 private wells consisting of: six private well system hose bibs (WP-27, WP-123, WP-125, WP-131, WP-167, and WP-168), and eight WHF systems (WP-14, WP-70, WP-83, WP-86, WP-119, WP-121, WP-124, and WP-129).

Even though a right of entry permit has been signed, and verbal or written permission granted to collect samples at each designated location, the environmental field team always attempted to contact the owner or resident at each private well location before beginning the field sampling activities. Upon arrival at each private well property designated for sample collection, the team verified they were at the correct address using maps, notes, and the sampling matrix, and verified through field documentation they were ready to collect samples at the correct sampling point (hose bib, or suitable water discharge port nearest to the wellhead).

To assist with the creation of an accurate project map, GPS coordinates were collected using a Trimble GeoXH Explorer GPS receiver at monitoring wells 00AW11, 92BW01 (not previously captured), WHF systems WP-119, WP-121, WP-124, WP-129 (in front of the well house sheds), and private wells WP-123, WP-125, WP-131, WP-167, and WP-168 (at the hose bib sample points).

Final stabilized flow cell readings for all private and WHF wells (except at WP-27 where the flow cell could not be used due to well system configuration) are shown in Table 1 below.

TABLE 1: PRIVATE WELL STABILIZED WATER QUALITY READINGS, NOVEMBER 2014

WELL	TEMP.°C	SpC mS/cm	D.O.	PH	ORP
WP-14	17.68	0.53	0.57	7.48	115
WP-70	16.13	0.45	0.99	7.52	156
WP-83	13.27	0.53	0.99	7.58	150
WP-86	13.3	0.53	1.02	7.54	184
WP-119	14.64	0.33	0.25	7.67	140
WP-121	11.53	0.33	0.13	8.19	108
WP-123	12.00	0.34	4.38	7.91	130
WP-124	14.54	0.34	0.43	7.96	132
WP-125	13.96	0.33	6.07	7.93	99
WP-129	13.52	0.36	0.15	8.43	90
WP-131	18.53	0.36	4.51	8.05	141
WP-167	13.52	0.36	6.67	8.00	114
WP-168	16.46	0.38	5.58	7.95	158

Special coordination had to be made with Clint Perry, operator of the multiple-home water system at WP-27 to arrange for system operation and sample collection at a specific time and date.

At the WHF locations, initial and post-sampling flow meter readings were recorded in the project field book. Upon achieving stabilization, the final stabilized readings were entered into the project field book. Prior to collecting a water sample, the flow rate at each tap was reduced to approximately 100 to 200 ml/min. to minimize sample aeration and turbulence. The sampling team donned new Nitrile gloves prior to sample collection at each residence. In the case of the WHF sample ports, restrictors on the sample ports provided a stream of sample water at approximately 150 to 200 ml/min. All sample containers were be filled with water directly from each tap – forming a meniscus at the top of each vial to provide zero headspace samples as required. A photographic record of each sample point was made by the team.

All required 40 ml VOA sample vials were obtained from Vendor ESS by the USACE contract lab ARI, and delivered to USACE pre-preserved with maleic and ascorbic acid.

Trip blanks were sent inside each sample shipping cooler delivered to the analytical lab.

Significant or unusual observations made during Private Well/WHF System Sampling

The frost-proof yard hydrant (riser pipe mounted hose bib) at WP-14 had to be held in a steady position to maintain a flow rate of approximately 500 ml/min. to prevent damage to the flow cell. The yard hydrant design cannot maintain a low-flow rate without being held by hand as discovered during sampling at WP-167.

In the wintertime, the pumping system at WP-27 runs only intermittently, and for a few minutes at a time. For this reason, the field team could not use the flow cell or purge the system for the standard 15 minute duration. Only one gallon was purged before collecting samples at this location, but data quality is not anticipated to be compromised.

The field team asked the resident at WP-70 to run (b) (6) itchen faucet fully open for 15 minutes for purging since no hose bib near the wellhead was available. The flow cell was connected to the Lead In line prior to entering the lead GAC filter to facilitate water quality readings during the purge time. Due to the presence of containerized chemicals stored inside the well house shed near sample port "C," one field blank sample was collected at WP-70. The team used reagent-grade water to collect the field blank within the same vicinity of where the port "C" sample was collected to detect any possible matrix interference from the stored chemicals.

Teflon sample tubing was attached to the hose bib at WP-123 to mitigate turbulent water flow. After decontamination, reagent grade water was passed through the tubing and collected as an equipment blank sample.

The resident at WP-125 directed the field team to use a garden hose (attached to the floor level hose bib sample point inside the well house shed) for purging and sample collection. The sampling team purged approximately seven gallons of water through the hose before beginning the standard purging procedures. During sample collection, they were able to adjust the flow rate to provide turbulence-free water samples.

The resident at WP-131 directed the field team to purge and collect samples from a hose bib on the east side of the house since the hose bib nearest the wellhead (the intended sample point) was shut off.

Door handle tags were attached to the front doors of the following three residences where private wells were sampled but the resident was not at home during sample collection activities: WP-123, WP-124, and WP-129. As mentioned previously, the door handle tags are intended to inform the residents that a sample had been collected by the USACE team while they were away from home, and provide them with a point of contact and phone number if they had any questions or concerns. Photos of the handle tags are maintained in USACE project files and are found at Appendix B.

Upon return from the project site on 20 November 2014, the USACE environmental field team hand delivered four coolers containing all November 2013 project samples under chain of custody directly to the contract laboratory to Analytical Resources, Inc. The team then returned to the USACE District Office in Seattle.

3.0 INVESTIGATION-DERIVED WASTE

No investigation-derived waste was generated during this sampling event. All residual PDB water or purged well water was transferred directly to ground surface on each property away from the sample collection point.

4.0 PACKAGING AND SHIPMENT

As mentioned in the narrative of each sampling event, groundwater samples were packaged in shipping coolers on ice and under chain of custody for hand delivery to the USACE contract laboratory Analytical Resources, Inc.

All sample shipping coolers were prepared for laboratory delivery in the following manner: Each cooler was lined (sides and bottom) with plastic "bubble-wrap" sheets for shock absorption. A large 30-gallon plastic garbage bag was then placed into the cooler to contain the sample water in the event of container breakage during shipment to the laboratories. The glass sample vials were labeled, placed into plastic zip-seal bags, and placed into foam shipping blocks or bubble-wrap bags for shock protection. All the samples were placed in the shipping coolers as indicated on the corresponding chain of custody forms. Gallon size plastic zipper bags of cubed ice bags were placed between and on top of the samples in each cooler to ensure maintenance of the required four degrees centigrade (plus/minus two degrees) sample preservation temperature. The completed chain of custody (COC) forms were placed in gallon size plastic zipper bags and taped to the inside of each cooler lid. Two custody seals were affixed to the outside of each cooler. The custody seals were placed so that the coolers could not be opened without breaking the seals. Each cooler was then securely sealed with fiber tape. The field team ensured drain plugs were securely taped inside and out to prevent possible water leakage.

The laboratory was informed of the sample delivery and ensured the samples were properly accepted and checked in upon receipt. All sample coolers and sample containers were accounted for at the contract laboratory following each shipment.

5.0 LABORATORY ANALYSIS

Chemical analyses performed on the samples were as follows: VOCs (Method 524.3).

6.0 DECONTAMINATION PROCEDURES

The flow cell and associated tubing, water level indicator meter, and water volume measurement containers used by each team were decontaminated at the end of the project with an Alconox®-water solution followed by triple rinsing using distilled water in the USACE Geology Laboratory.

7.0 PROTECTION LEVEL

All sampling activities were conducted under Worker Protection Level D. For this project, personnel protective equipment included reflective safety vests, safety splash protection glasses, Nitrile gloves, and safety steel toe boots. New pairs of Nitrile gloves were donned prior to handling acid-preserved sample containers and between each unique private well sample point or monitoring well.

End of Field Sampling Report

February 2014 Field Sampling Report

Private Wells
Groundwater Sampling Field Report
February 2014 Field Sampling Event

Moses Lake Wellfield Superfund Site
Moses Lake, Washington

Field Investigation:
19-21 February 2014
Report Prepared:
March 2014

By: Technical Services Branch

US Army Corps
of Engineers ®
Seattle District

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APPENDICES

1.0 BACKGROUND AND OBJECTIVE OF INVESTIGATION

1.1 BACKGROUND

The Moses Lake Wellfield Superfund Site is located between the Grant County Airport and the City of Moses Lake, Washington. The Site includes the former Larson Air Force Base (LAFB) property, Port of Moses Lake property and adjacent private properties affected by Site groundwater contamination. The Site is listed on the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980 National Priorities List (NPL) for Uncontrolled Hazardous Waste Sites.

The Moses Lake Wellfield Superfund Site is an area of approximately 15 square miles, which includes the former LAFB, commercial facilities, and residences. The former LAFB occupied approximately 9,607 acres three miles northwest of the City of Moses Lake. The United States Air Force was active at the site from 1942 until 1966. During 1988 and 1989, the Washington State Department of Health confirmed the presence of trichloroethylene (TCE) above the Federal Maximum Contaminant Level (MCL) in three City of Moses Lake municipal wells and two Skyline community wells. The Seattle District, US Army Corps of Engineers (USACE) completed a Remedial Investigation (RI) phase in 2003. Appendix A of this report shows the general location map and a site map.

During the course of the RI, several private wells were tested and found to be contaminated with TCE. In 2001, the USACE contracted installation of carbon filtration units – known as whole house filter systems (WHF) - at five of those wells. Several years of groundwater monitoring data has been evaluated since the original WHF systems were installed.

The final results of the Phase I RI released in a report in March 1993 indicated that TCE was consistently found in shallow alluvial and upper basalt (*a*-basalt) groundwater in the central area of the former base.

On October 14, 1992, the affected areas of the former LAFB and off-site down gradient areas, termed the "Moses Lake Wellfield Contamination", were listed on the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) of 1980 for Uncontrolled Hazardous Waste Sites. The former LAFB property is one part of the Moses Lake Wellfield Superfund Site; the site also includes the contaminant plume.

Chemical results from 1993 and 1994 combined with historical data indicated that TCE occurred in the central and southern portion of the former LAFB in alluvial and *a*-basalt groundwater. In 2004, USACE confirmed TCE contamination in the next lower basalt aquifer (c-basalt). As of 1995, the data suggest that more than one source may have contributed TCE to the alluvial and *a*-basalt groundwater in the central portion of the former LAFB.

In 1998, URS Greiner completed a sampling round of private water wells and wells for Class A and Class B water systems east, south and southwest of the previously known TCE plume. There were eight detections of TCE during this study. Four wells that were previously outside the plume extent were found to be above the detection limit.

1.2 Groundwater Sampling Event Summary and Objectives

In coordination with the US Environmental Protection Agency (USEPA) Region 10, the USACE environmental field team comprised of Joseph Marsh and David Sullivan deployed to conduct the February 2014 Moses Lake Wellfield groundwater sampling event. The activities described in this report involve the USACE environmental field team verifying sample point locations; discussion of sampling techniques; recording groundwater observations; collection of groundwater samples; and shipping those samples by overnight delivery for laboratory analysis.

All of the work described in this report was accomplished in accordance with the Moses Lake Wellfield Superfund Site Quality Assurance Project Plan. In addition, the team followed the guidance presented in: the Seattle District, USACE Safety and Health Plan; USACE Safety Manual EM 385-1-1; and Seattle District, USACE, Sampling Standard Operating Procedures (SOP) for environmental field sampling.

The private wells designated for sampling are displayed on maps found at Appendix A. These wells have been selected based on their down-gradient locations relative to the inferred flow direction of TCE-contaminated groundwater and validated sampling analytical data from previous monitoring events.

The February 2014 sampling event included groundwater sample collection from six private wells, and eight WHF systems. Groundwater samples were not collected from monitoring wells during this event. The sampling event was conducted between 19 and 21 February, 2014.

The objectives of groundwater sampling at Moses Lake are to: 1) collect representative samples from designated private well systems and monitoring wells yielding data of known and sufficient quality to evaluate TCE concentrations and define existing TCE plumes; 2) to assure compliance with the requirements of USEPA; and 3) to make critical project - specific decisions based on the evaluated data.

2.0 DESCRIPTION OF WORK

2.1 Activities Prior to the February 2014 Groundwater Sampling Event

The USACE project team worked to collect signatures on Department of the Army Right of Entry forms as required before conducting the well sampling on private, city or county government property. For most properties, previously signed Right of Entry forms were still valid. For all properties designated for sample collection, owners (and renters if applicable) were contacted to coordinate sample collection times during the scheduled field sampling week. Many of the owners allowed the field team to work on their property while they were not at home. At some of the properties, home owners or well system managers had to unlock pump houses and open valves for the team – requiring prior coordination.

Prior to conducting sampling activities at each location, the team verified the address or well location and map location matched, and that the Right of Entry form had been signed prior to arriving at each sampling location.

The field team was responsible for identifying potential health and safety hazards at each sampling location. If a hazard is verified at a private well sampling location, an alternate hose bib connected to the same water source may be selected in a safer area of the subject property. In the case of hazardous monitoring well conditions, rescheduling the collection time or date when the hazards no longer exist may be required.

Also for private well sampling, the field team was tasked with determining the most appropriate cold-water tap or other sample port as close to each wellhead as practical, while comparing notes on sample points collected during previous sampling events. The team was briefed that groundwater samples would not be collected from taps delivering chlorinated, aerated, softened or filtered water.

2.2 Private Well Sampling Procedures

Per established standard operating procedure, private well purging flow rate has been set at approximately one gallon per minute (3.8 liters) maximum as verified by graduated cylinder or other suitable water measurement container. During flow rate adjustments, the team monitored the surrounding area and flowing water for unusual observations and odors as purge water is captured in a five gallon purge water bucket. They recorded the start time of the 15 minute purging in the field logbook immediately after opening each hose bib sample point.

After recording brief observations at each private well from the opened sample point hose bib valve, the sample point valve was temporarily closed to allow connection of the flow cell inlet tubing assembly. The flow cell inlet port was connected to the designated sample point (hose bib) using a specialized “Tee” tubing assembly allowing well water to flow directly into the five gallon purge water bucket at a high flow rate while allowing well water to be conveyed directly to the flow cell at a lower flow rate as required to prevent instrument damage.

The sample point hose bib and flow control valve on the tubing assembly was slowly opened to a maximum measured flow rate not to exceed 500 ml/min. to avoid damaging the sensitive flow cell probes with excessive water pressure. Once that was achieved, the flow rate at the bypass tubing was measured and recorded in the field book along with the official purging start time. Flow cell measurements would be recorded in the project field book every two minutes until the water quality parameters stabilized.

Stabilization parameter requirements for all private wells and WHF systems are as follows:

Temperature	+/- 0.2 ºC
Specific Conductivity	+/- 0.020 millisiemens/centimeter (mS/cm)
DO	+/- 0.2 milligrams/liter (mg/l)
pH	+/- 0.2 units
ORP	+/- 20 millivolts (mV)

If stabilization occurred before the 15 minute total required purge time (usually within six to eight minutes during this event), final stabilized measurements were recorded in the field book, and purging continued until 15 minutes total purge time had elapsed. At that time, the flow cell was powered down and the associated flow cell inlet tubing disconnected from the flow cell. Purged water continued to be captured in a five-gallon bucket through the bypass tubing at a rate of approximately one gpm.

After 15 minutes has elapsed, the sample point hose bib was shut off, and the tubing assembly removed to permit sampling directly from the hose bib. The approximate total purged volume and stabilized water quality readings were recorded in the project field book along with any other significant observations. The team then conducted the sample collection activities.

Prior to collecting a water sample, the flow rate was reduced at each tap to approximately 150 to 200 ml/min. to minimize sample water turbulence and aeration. Prior to sample collection at each private well system, the samplers donned protective eyewear and new, clean, Nitrile gloves to prevent exposure to contaminants and cross-contamination. All groundwater samples were collected in pre-cleaned certified containers obtained from the analytical laboratory.

All sample containers were filled with water directly from each tap – forming a meniscus at the top of each vial to provide zero headspace samples as required. Sample point location and components of each plumbing system were noted to assist in data interpretation.

A photographic record of each sample point was made by the team. In addition, handle tags (indicating that water samples were taken by USACE on that date and time) are placed on the front doors of homes sampled if nobody was home during sample collection. A photo was taken of the handle tag and front of house in that case for the project files.

After the sample containers are filled, sample labels describing project, location, analysis, team members, preservative, sampling date, and collection time are placed on the containers. The samples are then packaged in bubble wrap bags and plastic zipper type bags, placed into pre-iced sample shipping coolers and prepared for shipment as described in Section 3.0. All personnel worked to ensure each property was left just as they found it with no damage done, and any doors or gates closed as required.

2.3 WHOLE HOUSE FILTER SAMPLING PROCEDURES

In coordination with USEPA and affected Moses Lake area homeowners, granular activated carbon (GAC) water filters have been installed in private well systems showing TCE results of 3.5 µg/l or greater. Each GAC filter system consists of two lightweight composite GAC filter tanks (acting as lead and lag filters), associated piping, bag filters (to prevent GAC particles from entering the household plumbing system), pressure gauges and valved/regulated sample collection ports.

Each system was purged according to the current private well sampling SOP described in Section 2.2 of this report. A hose bib nearest the well head was opened and a flow rate of approximately one gallon per minute (gpm) established as measured with graduated cylinder. The purged water was captured in a five gallon bucket and simultaneously directed into a flow cell at a reduced flow rate to facilitate the collection of water quality parameter data consisting of temperature, specific conductivity, dissolved oxygen, pH, oxygen reduction potential, and turbidity. Once stabilization of these water quality parameters was achieved, the final readings were recorded and purging continued until 15 minutes had elapsed. The hose bib was closed and sampling commenced after 15 minutes of purging was completed at each location.

WHF sampling ports consist of three locations labeled “A” for the lead inlet port, “B” for the lead filter outlet port, and “C” for the lag filter outlet port.

WHF sample collection consists of opening each designated sample port valve fully to allow the maximum restricted flow rate of approximately 150 to 200 ml/min to flow into a capture bucket for a few seconds to ensure organic matter or air bubbles have been flushed out of the system. Restrictors have been placed on the sampling lines to provide a smooth, non-turbulent stream at a low-flow rate to minimize loss of volatiles that may be present in the water stream. Next, the sampling team immediately fills three pre-preserved VOA vials to zero headspace. New Nitrile gloves were donned before collecting samples at each port. All discharged water was directed into a five gallon plastic bucket for transfer to ground surface away from the shed or pump house GAC filter location after the samples were collected.

2.4 Sampling Event Activities and Observations

2.4.1 Private Well and WHF System Sampling

During the February 2014 groundwater sampling event, samples were collected from a total of 14 private wells consisting of: six private well system hose bibs (WP-27, WP-123, WP-125, WP-131, WP-167, and WP-168), and eight WHF systems (WP-14, WP-70, WP-83, WP-86, WP-119, WP-121, WP-124, and WP-129).

Even though a right of entry permit has been signed, and verbal or written permission granted to collect samples at each designated location, the environmental field team always attempted to contact the owner or resident at each private well location before beginning the field sampling activities. Upon arrival at each private well property designated for sample collection, the team verified they were at the correct address using maps, notes, and the sampling matrix, and verified through field documentation they were ready to collect samples at the correct sampling point (hose bib, or suitable water discharge port nearest to the wellhead).

Final stabilized flow cell readings for all private and WHF wells (except at WP-27 and WP-70 where the flow cell could not be used due to well system configuration) are shown below.

TABLE 1: PRIVATE WELL STABILIZED WATER QUALITY READINGS, FEBRUARY 2014

WELL	TEMP.°C	SpC mS/cm	D.O.	PH	ORP
WP-14	20.35	0.52	0.33	7.33	164
WP-83	11.70	0.49	0.30	7.08	202
WP-86	11.10	0.48	2.17	6.99	458
WP-119	11.58	0.31	0.28	7.14	320
WP-121	8.72	0.31	0.25	7.74	235
WP-123	11.46	0.31	2.86	7.23	388
WP-124	10.63	0.31	2.54	7.28	370
WP-125	10.56	0.31	7.85	7.66	331
WP-129	15.10	0.34	0.30	7.46	590
WP-131	11.63	0.33	6.33	7.82	579
WP-167	14.09	0.32	7.59	7.73	405
WP-168	12.64	0.36	5.73	7.73	394

Special coordination was made with (b) (6), owner/operator of the multiple-home water system at WP-27 to arrange for system operation and sample collection at a specific time and date.

At the WHF locations, initial and post-sampling flow meter readings were recorded in the project field book. Upon achieving stabilization, the final stabilized readings were entered into the project field book. Prior to collecting a water sample, the flow rate at each tap was reduced to approximately 100 to 200 ml/min. to minimize sample aeration and turbulence. The sampling team donned new Nitrile gloves prior to sample collection at each residence. In the case of the WHF sample ports, restrictors on the sample ports provided a stream of sample water at approximately 150 to 200 ml/min. All sample containers were be filled with water directly from each tap – forming a meniscus at the top of each vial to provide zero headspace samples as required. A photographic record of each sample point was made by the team.

All required 40 ml VOA sample vials were obtained from Vendor ESS by the USACE contract lab ARI, and delivered to USACE pre-preserved with maleic and ascorbic acid.

Trip blanks were sent inside each sample shipping cooler delivered to the analytical lab.

Significant or unusual observations made during Private Well/WHF System Sampling

The frost-proof yard hydrant (riser pipe mounted hose bib) at WP-14 had to be held in a steady position to maintain a flow rate of approximately 500 ml/min. to prevent damage to the flow cell. The yard hydrant design cannot maintain a low-flow rate without being held by hand as discovered during sampling at WP-167.

In the wintertime, the pumping system at WP-27 runs only intermittently, and for a few minutes at a time. For this reason, the field team could not use the flow cell or purge the system for the standard 15 minute duration. Only one gallon was purged before collecting samples at this location, but data quality is not believed to be compromised since the water was pumped directly from the adjacent well.

The field team asked the resident at WP-70 to run (b)(6) kitchen faucet fully open for 15 minutes for purging since no hose bib near the wellhead was available. The flow cell could not be used, and water quality readings were not measured at WP-70 for this reason. Due to the presence of containerized chemicals stored inside the well house shed near sample port "C", one field blank sample was collected at WP-70. The team used reagent-grade water to collect the field blank within the same vicinity of where the port "C" sample was collected to detect any possible matrix interference from the stored chemicals.

The resident at WP-86 reported the light was not working in the well house/WHF shed, and asked for the USACE project manager to contac (b)(6) bout having the light repaired. The field team forwarded this information to the USACE project manager.

WP-124 WHF system anomalies: The "A" port was missing a length of ¼-inch sample tubing after the flow restrictor intended to reduce turbulence in the water sample. However, turbulence-free samples were still obtained from this sample port. A minor leak was observed at the sample port "B" valve/sample tubing interface during sample collection when the valve was opened. Minor leaking was also observed at the valve of sample port "C" during sample collection when the valve was opened. These leaks may be due to faulty sample tubing installation. Recommend repairs be made by contractor.

WP-121 WHF system anomalies: The "A" and "C" ports were leaking at the valves during sample collection with the valves opened possibly due to the original sample tubing installation.

Sample port “B” dripped slowly during sample collection when the valve was opened. Recommend repairs be made by contractor.

WP-129 WHF system anomalies: The “C” port was observed leaking at the valve/sample tubing interface possibly due to the original sample tubing installation. Recommend repairs be made by contractor.

The resident at WP-125 directed the field team to use a garden hose (attached to the floor level hose bib sample point inside the well house shed) for purging to keep the floor dry in the shed. During sample collection, the team attached a six foot length of Teflon sample tubing to the floor level hose bib and collected samples outside of the shed to fully comply with the request. An equipment blank was collected using reagent grade water passed through the Teflon tubing once it was decontaminated.

Door handle tags were attached to the front doors of WP-123, and WP-167 where private wells were sampled but the resident was not at home during sample collection activities. As mentioned previously, the door handle tags are intended to inform the residents that a sample had been collected by the USACE team while they were away from home, and provide them with a point of contact and phone number if they had any questions or concerns. Photos of the handle tags are maintained in USACE project files and are found at Appendix B.

The resident at WP-167 came home after the handle tag was left on his door handle. Since the field team was next door at the time, the resident requested the wording on the handle tag be simplified since he was not sure if the tag meant that USACE had already collected the samples, or we needed to come back to collect the samples. The team agreed to update the handle tags.

On 21 November, 2014, the USACE environmental field team returned to the USACE District Office in Seattle.

3.0 INVESTIGATION-DERIVED WASTE

No investigation-derived waste was generated during this sampling event. All residual water or purged well water was transferred directly to ground surface on each property away from the sample collection point.

4.0 PACKAGING AND SHIPMENT

All sample shipping coolers were prepared for laboratory delivery in the following manner: Each cooler was lined (sides and bottom) with plastic “bubble-wrap” sheets for shock absorption. A large 30-gallon plastic garbage bag was then placed into the cooler to contain the sample water in the event of container breakage during shipment to the laboratories. The glass sample vials were labeled, placed into plastic zip-seal bags, and placed into foam shipping blocks or bubble-wrap bags for shock protection. All the samples were placed in the shipping coolers as indicated on the corresponding chain of custody forms. Gallon size plastic zipper bags of cubed ice bags were placed between and on top of the samples in each cooler to ensure maintenance of the required four degrees centigrade (plus/minus two degrees) sample preservation temperature. The completed chain of custody (COC) forms were placed in gallon size plastic zipper bags and taped to the inside of each cooler lid. Two custody seals were affixed to the outside of each cooler. The custody seals were placed so that the coolers could not be opened without breaking the seals. Each cooler was then securely sealed with fiber tape. The field team ensured drain plugs were securely taped inside and out to prevent possible water leakage.

The laboratory was informed of the sample delivery and ensured the samples were properly accepted and checked in upon receipt the following morning after the sample containers were shipped. All sample coolers and sample containers were accounted for at the contract laboratory following each shipment.

Groundwater samples collected during this field event were packaged in sample coolers for priority overnight delivery via Fedex under chain of custody to the USACE contract laboratory Analytical Resources, Inc. On 20 February 2014, one sample cooler was shipped to the laboratory from the Grant County Airport Fedex station. On 21 February, 2014, the two final sample coolers were shipped to the laboratory also from the Grant County Airport Fedex station.

5.0 LABORATORY ANALYSIS

Chemical analyses performed on the samples were as follows: VOCs (Method 524.3).

6.0 DECONTAMINATION PROCEDURES

The flow cell and associated tubing, water level indicator meters, and water volume measurement containers used by each team were decontaminated at the end of the project with an Alconox®-water solution followed by triple rinsing using distilled water in the USACE Geology Laboratory.

7.0 PROTECTION LEVEL

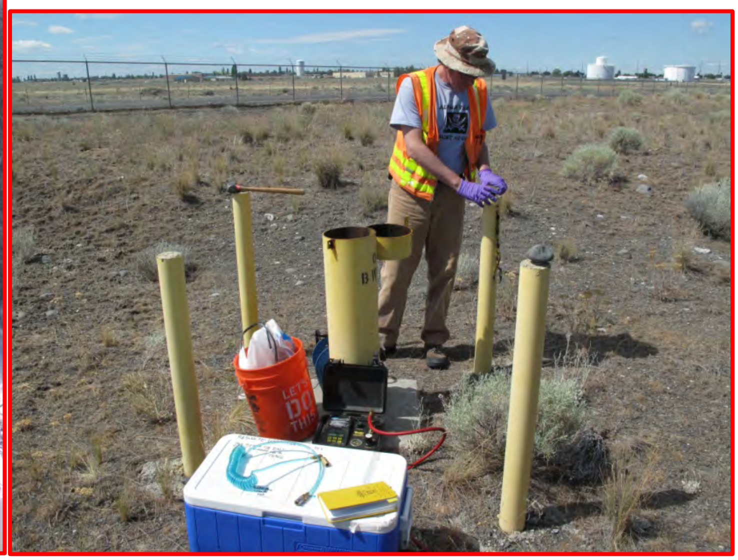
All sampling activities were conducted under Worker Protection Level D. For this project, personnel protective equipment included reflective safety vests, safety splash protection glasses, Nitrile gloves, and safety steel toe boots. New pairs of Nitrile gloves were donned prior to handling acid-preserved sample containers and between each unique private well sample point or monitoring well.

End of Field Sampling Report

May/June 2014 Field Sampling Report

Private Wells and Monitoring Wells Groundwater Sampling Field Report
June 2014 Field Sampling Event

Moses Lake Wellfield Superfund Site
Moses Lake, Washington



Field Investigation:
22-27 June 2014
Report Prepared:
August 2014

By: Technical Services Branch

US Army Corps of Engineers ®
Seattle District

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APPENDICES

1.0 BACKGROUND AND OBJECTIVE OF INVESTIGATION

1.1 BACKGROUND

The Moses Lake Wellfield Superfund Site is located between the Grant County Airport and the City of Moses Lake, Washington. The Site includes the former Larson Air Force Base (LAFB) property, Port of Moses Lake property and adjacent private properties affected by Site groundwater contamination. The Site is listed on the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980 National Priorities List (NPL) for Uncontrolled Hazardous Waste Sites.

The Moses Lake Wellfield Superfund Site is an area of approximately 15 square miles, which includes the former LAFB, commercial facilities, and residences. The former LAFB occupied approximately 9,607 acres three miles northwest of the City of Moses Lake. The United States Air Force was active at the site from 1942 until 1966. During 1988 and 1989, the Washington State Department of Health confirmed the presence of trichloroethylene (TCE) above the Federal Maximum Contaminant Level (MCL) in three City of Moses Lake municipal wells and two Skyline community wells. The Seattle District, US Army Corps of Engineers (USACE) has completed a Remedial Investigation (RI) phase in 2003. Appendix A of this report shows the general location map and a site map.

During the course of the RI, several private wells were tested and found to be contaminated with TCE. In 2001, the USACE contracted installation of carbon filtration units – known as whole house filter systems (WHF) - at five of these wells. Several years of groundwater monitoring data has been evaluated since the WHF systems were installed.

The final results of the Phase I RI released in a report in March 1993 indicated that TCE was consistently found in shallow alluvial and upper basalt (*a*-basalt) groundwater in the central area of the former base.

On October 14, 1992, the affected areas of the former LAFB and off-site down gradient areas, termed the "Moses Lake Wellfield Contamination", were listed on the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) of 1980 for Uncontrolled Hazardous Waste Sites. The former LAFB property is one part of the Moses Lake Wellfield Superfund Site; the site also includes the contaminant plume.

Chemical results from 1993 and 1994 combined with historical data indicated that TCE occurred in the central and southern portion of the former LAFB in alluvial and *a*-basalt groundwater. In 2004, USACE confirmed TCE contamination in the next lower basalt aquifer (c-basalt). As of 1995, the data suggest that more than one source may have contributed TCE to the alluvial and *a*-basalt groundwater in the central portion of the former LAFB.

In 1998, URS Greiner completed a sampling round of private water wells and wells for Class A and Class B water systems east, south and southwest of the previously known TCE plume. There were eight detections of TCE during this study. Four wells that were previously outside the plume extent were found to be above the detection limit.

1.2 FY 13 GROUNDWATER SAMPLING SUMMARY AND OBJECTIVES

In coordination with the US Environmental Protection Agency (USEPA) Region 10, three USACE field sampling teams conducted the June 2014 Moses Lake Wellfield groundwater sampling event during one unified mobilization. The events described in this report involve USACE environmental field teams verifying sample point locations; discussion of sampling techniques; recording groundwater observations; collecting groundwater samples; and shipping those samples by overnight delivery for laboratory analysis. Environmental sampling team members included Joseph Marsh, Matt Brookshier, David Sullivan, Karah Haskins, Blair Kinser, and Rebecca Weiss.

All of the work described in this report was accomplished in accordance with the Moses Lake Wellfield Superfund Site Quality Assurance Project Plan. In addition, the team followed the guidance presented in: the Seattle District, USACE Safety and Health Plan; USACE Safety Manual EM 385-1-1; Seattle District, USACE, Sampling Standard Operating Procedures (SOP).

The private wells and monitoring wells designated for sampling is displayed on a map found at Appendix A. These wells have been selected based on their down-gradient locations relative to the inferred flow direction of TCE-contaminated groundwater and validated sampling analytical data from previous monitoring events.

The three sampling teams collected groundwater samples from 68 private wells, and 71 monitoring wells during the June 2014 sampling event as summarized below:

Team 1: 33 private wells sampled between 23 and 26 June 2014.

Team 2: 35 private wells sampled between 23 and 26 June 2014.

Team 3: 71 monitoring wells (36 bladder pump wells, 35 passive diffusion bag wells) sampled between 22 and 27 June 2014.

The objectives of groundwater sampling at Moses Lake are to: 1) collect representative samples from designated private well systems and monitoring wells yielding data of known and sufficient quality to evaluate TCE concentrations and define existing TCE plumes; 2) to assure compliance with the requirements of USEPA; and 3) to make critical project - specific decisions based on the evaluated data.

2.0 DESCRIPTION OF WORK

2.1 ACTIVITIES PRIOR TO THE JUNE 2014 GROUNDWATER SAMPLING EVENT

The USACE project team worked to collect signatures on Department of the Army Right of Entry forms as required before conducting the well sampling on private, city or county government property. For most properties, previously signed Right of Entry forms were still valid. For all properties designated for sample collection, owners (and renters if applicable) were contacted to coordinate sample collection times during the scheduled field sampling week. Many of the owners allowed the sampling teams to work on their property while they were not at home. At some of the properties, home owners or well system managers had to unlock pump houses and open valves for the sampling teams – requiring prior coordination.

Because of the large number of wells to be sampled, the June 2014 event followed the similar deployment of several USACE sampling teams during the summer of 2013 to accomplish the field work simultaneously. The sampling teams worked independently each day, collecting groundwater samples from a pre-determined list of private wells and monitoring wells located across the entire expanse of the Site, and shipping the samples off to the analytical laboratory.

During the sampling event, each team verified the address and map location were correct, and that the Right of Entry form had been signed prior to arriving at each sampling location.

Each team was responsible for identifying potentially dangerous conditions at each sampling location. If so, an alternate water tap would be selected for sample collection in a safer area of the property. Also, if the pump was not operating at a specific residence, and the owner/tenant could not start the pump, no sampling would be conducted at that location (the teams did not experience this problem). The sampling teams were also tasked with determining the most appropriate cold-water tap or other sample port as close to each wellhead as practical, while comparing notes on sample points collected during previous sampling events. The teams were briefed that groundwater samples would not be taken from taps delivering chlorinated, aerated, softened or filtered water.

2.1.1 Whole House Filter Change-out Groundwater Sampling

On 19 May, 2014, a USACE environmental field team comprised of Joseph Marsh and David Sullivan collected groundwater samples from four whole house filter systems prior to change-out of the granular activated carbon (GAC) filter media. These four systems (WP-70, WP-86, WP-83, and WP-14) were completely rebuilt, re-plumbed, and new GAC installed during May of 2013. At these four upgraded WHF systems, the sampling team followed the USACE SOP developed for private well and WHF systems for purging and collection of groundwater samples. The team collected water samples from the lead, mid, and lag (labeled A, B, and C respectively) sample ports to provide data on the filter systems effectiveness in capturing the target contaminants at the end of the planned filter life.

On 21 May, 2014, Marsh and Sullivan returned to the same four WHF systems after GAC change-out. Samples were collected from the B (mid filter) and C (lag filter) sample ports to verify the effectiveness of the new filter media. All samples were shipped to the analytical laboratory via Fedex priority overnight delivery. During this May 2014 field work, Marsh and Sullivan also installed passive diffusion bags in 35 monitoring wells designated for sample collection during June 2014 (as described in Section 2.6.3.1). These four specific WHF systems (WP-70, WP-86, WP-83, and WP-14) were not re-sampled during the June sampling event.

2.2 Whole House Filter Sampling Procedures

Two lightweight composite GAC filter tanks (acting as lead and lag filters), associated piping, bag filters (to prevent GAC particles from entering the household plumbing system), pressure gauges and sample ports have been installed in eight private well systems showing TCE results of 3.5 µg/l or greater at the Site. Groundwater samples were collected from WHF systems located at WP-121 and WP-129 during the June 2014 sampling event. Each system was purged according to the current private well sampling SOP described in the following sections of this report. Purge flow rates averaged one gallon per minute (gpm) as measured with graduated cylinder, and purged water was captured in a five gallon bucket and simultaneously directed into a flow cell to facilitate the collection of water quality parameter data consisting of temperature, specific conductivity, dissolved oxygen, pH, oxygen reduction potential, and turbidity. Sampling commenced after 15 minutes of purging was completed at each location. Sample collection consisted of regulating the flow rate of each port to approximately 200 ml/min. to achieve a smooth, non-turbulent stream if possible, then filling three pre-preserved VOA vials to zero headspace. New Nitrile gloves were donned before collecting samples at each port. All discharged water was directed into a five gallon plastic bucket for transfer to ground surface outside of the pump house after the samples were collected.

2.3 Private Well Sampling Procedures

For the June 2014 sampling event, USEPA and USACE have determined the purge time to be 15 minutes at each sample point verified by stabilized readings (same as monitoring well stabilization parameters shown in Section 2.4.1) using a multi-probe flow cell (QED Model MP-20). The flow rate during purging has been established at approximately one gallon per minute (3.8 liters) maximum as verified by graduated cylinder or other suitable water measurement containers. This one gpm rate has been determined to be the average maximum achievable flow rate using existing bypass hoses and tubing for the flow cell. During flow rate adjustments, the teams monitored the surrounding area and flowing water for unusual observations and odors as purge water is captured in a five gallon purge water bucket. They recorded the start time of the 15 minute purging in the field logbook immediately after opening each hose bib sample point. While one team member recorded field data, the other used a precision GPS receiver to record new sample point coordinates for updating the project map if required by the USACE project team.

After recording brief observations at each private well from the opened sample point hose bib valve, the sample point valve was temporarily closed to allow connection of the flow cell inlet tubing assembly. If petroleum products or chemicals were observed (or odors detected) near the sampling point, the team may decide to collect a field blank sample if matrix interference is suspected.

The flow cell inlet port was connected to the designated sample point (hose bib) using a specialized ‘Tee” tubing assembly allowing well water to flow directly into the five gallon purge water bucket at a high flow rate while allowing well water to be conveyed directly to the flow cell at a lower flow rate as required to prevent instrument damage. To achieve this result, approximately two feet of 5/8-inch inside diameter flexible garden hose was connected to a threaded fitting adapted for the standard threaded tap size – this end of the assembly will be attached to each designated hose bib. At the downstream open end of this length of hose, a 5/8-

inch inside diameter Teflon tee was attached, and another two foot length of garden hose fastened to the 90 degree discharge was then directed into a purge bucket. This length of garden hose is fitted with a Teflon globe valve to provide sufficient backpressure to allow water to travel through the flow cell (Without a flow control valve adjusted to create a slight backpressure, water did not enter the flow cell during prototype testing.). The straight discharge end of the Teflon tee was connected to a short length of garden hose, and sized down using stiff polyethylene and flexible Tygon® tubing to permit a connection to the flow cell ¼-inch inside diameter Tygon® flow cell inlet tubing. The inlet tubing was then attached to the flow cell with a quick connect fitting. The flow cell outlet was a three foot length of 3/8-inch inside diameter Tygon® tubing attached to the flow cell outlet quick connect and directed into the purge water bucket. Both private well teams had a tubing Tee assembly and flow cell to conduct their own purging activities.

The sample point hose bib and flow control valve on the tubing assembly was slowly opened to a maximum measured flow rate not to exceed 500 ml/min. to avoid damaging the sensitive flow cell probes with excessive water pressure. Once that was achieved, the flow rate at the bypass tubing was measured and recorded in the field book along with the official purging start time.

As the water was observed flowing through the flow cell system and out into the purge bucket, each team would then record flow cell measurements in their field books every two minutes until the parameters stabilized. If stabilization occurred before the 15 minute total required purge time (as it did at every well), final stabilized measurements were recorded in the field book, and purging continued until 15 minutes total purge time had elapsed. At that time, the flow cell was powered down and the associated flow cell inlet tubing disconnected from the flow cell. Purged water continued to be captured in a five-gallon bucket through the bypass tubing at a rate of approximately one gpm.

After 15 minutes has elapsed, the sample point hose bib was shut off, and the tubing assembly removed to permit sampling directly from the hose bib. The approximate total purged volume and stabilized water quality readings were recorded in the project field book along with any other significant observations. The team then conducted the sample collection activities.

Prior to collecting a water sample, the team reduced the flow rate at each tap to approximately 100 to 200 ml/min. to minimize sample water turbulence and aeration. Prior to sample collection at each private well system, the samplers donned protective eyewear and new, clean, Nitrile gloves to prevent exposure to contaminants and cross-contamination. All groundwater samples were collected in pre-cleaned certified containers obtained from the analytical laboratory.

All sample containers were filled with water directly from each tap – forming a meniscus at the top of each vial to provide zero headspace samples as required. Sample point location and components of each plumbing system were noted to assist in data interpretation. A photographic record of each sample point was made by the team. In addition, each team placed handle tags (indicating that water samples were taken by USACE on that date and time) on the front doors of homes sampled if nobody was home during sample collection. A photo was taken of the handle tag and front of house in that case for the project files.

After the sample containers are filled, sample labels describing project, location, analysis, team members, preservative, sampling date, and collection time are placed on the containers. The samples are then packaged in bubble wrap bags and plastic zipper type bags, placed into pre-iced sample shipping coolers and prepared for shipment as described in Section 3.0. All sampling teams worked to ensure each property was left just as they found it with no damage done, and any doors or gates closed as required.

NOTE: The USACE Environmental Center of Expertise is assisting with a revision of the SOPs detailed here for future WHF systems and private well sampling with the intent of increasing reliability and repeatability in analytical data quality.

2.4 Monitoring Well Sampling Procedures

2.4.1 Monitoring Well Sampling Using Dedicated Bladder Pumps

Moses Lake monitoring well groundwater purging and sampling was performed in accordance with the Seattle District's Low-Flow Ground Water Purging and Sampling SOP, prepared in March 1999 and revised on 1 Sep 2009. Data generated during purging were recorded on the MicroPurge/Low-Flow Sampling Log forms (Appendix C).

The team verified each monitoring well location and identification number with project maps and tables. They verified work can proceed safely in the vicinity of moving vehicular traffic as required. The team used a pry bar, socket wrench or pinhead hex wrench as needed to open each flush mount monitoring well cover plate, and a Masterlock #485 padlock key for the standard "stick-up" well completions. Prior to purging each well, the depth to static water level in each well was measured and checked periodically to monitor draw down as a guide to flow rate adjustment (no greater than 0.4 foot drawdown is permitted to prevent sampling stagnant casing water).

Purging operations at each well commenced once the following equipment was prepared: the MP20 MicroPurge® Controller equipped with an adjustable pressure regulator was connected to the Well Wizard® bladder pumps via air line and quick connect fittings. Another air line was quick-connected to a pressurized CO2 cylinder to drive the pump. Pump flow rates were then adjusted during a "pre-purge" period to maximize withdrawal rates and minimize excessive drawdown in each well. The evacuated pre-purge volume at each well was intended to flush out a bladder pump and tubing volume prior to monitoring stabilization parameters. Finally, a QED MicroPurge® basics MP20 Flow Cell was connected to the pump's discharge line at ground surface to measure established stabilization parameters (pH, specific conductivity, temperature, DO, ORP, and turbidity).

Depth to water measurements during purging were monitored and recorded to verify that minimal drawdown occurred. A graduated measuring cup was used to determine the volume purged. Generally, acceptable low-flow rates are no greater than 500 milliliters per minute (ml/min.), and are typically closer to 400 ml/min. for the Well Wizard® bladder pump systems, depending upon the amount of water level drawdown detected during pumping at each well. Purge data was recorded on the micropurge logs every two minutes.

Low-flow purging continued until three consecutive measurements of the stabilization parameters met stabilization requirements.

Stabilization parameter requirements for all private well and bladder pump monitoring wells are as follows:

Temperature	+/- 0.2 ºC
Specific Conductivity	+/- 0.020 milisiemens/centimeter (mS/cm)
DO	+/- 0.2 milligrams/liter (mg/l)
pH	+/- 0.2 units
ORP	+/- 20 millivolts (mV)

At each monitoring well, groundwater sample collection would begin immediately after achieving stabilization of water quality parameters during low flow purging.

Prior to sample collection, the samplers donned protective eyewear and new, clean, Nitrile gloves to prevent exposure to contaminants and cross-contamination. All groundwater samples were collected in pre-cleaned certified containers obtained from the analytical laboratory.

All sample containers were filled immediately following purging by disconnecting the flow-through cell from the pump tubing system, and capturing water directly from the discharge end of the tubing. All sample containers were carefully filled at a low-flow rate to minimize agitation. During sample collection, significant physical observations were recorded in the Micropurge/Low-Flow Sampling Log data forms and project field book as needed.

After filling the sample containers, sample labels describing project, location, analysis, team members, preservative, sampling date, and collection time were placed on each container and the container was placed in a plastic zipper bag. The bagged sample vials were placed into bubble wrap bags. Finally, the filled sample containers were placed into pre-iced shipping coolers to begin sample cooling to the required 4° centigrade sample preservation temperature prior to shipment to the analytical laboratory.

At the conclusion of groundwater sampling at each well, the flush mount well covers were bolted closed and stick up well caps padlocked.

2.4.2 Monitoring Well Sampling Using Passive Diffusion Bags

Passive diffusion bags (PDBs) were been selected by the Moses lake Project Delivery Team as the most appropriate, cost-effective method for groundwater sample collection from Moses Lake monitoring wells lacking dedicated bladder pumps. The PDBs were purchased from ALS Environmental laboratory under license by the US Geological Survey and The General Electric Company, both co patent-holders. The 1 ¼" diameter low-density polyethylene PDBs were pre-filled with 220 ml or 330 ml of ASTM Type II certified, laboratory-grade, deionized water.

Each filled PDB was then heat sealed by the laboratory prior to shipment to USACE via overnight delivery in hermetically sealed pouches.

The environmental field team allowed a minimum of 14 days to elapse before returning to the Moses Lake site for groundwater sample collection per PDB guidance. PDB retrieval and sampling consisted of the following procedures:

1. The team verified each monitoring well location and identification number with project maps and tables. They verified work can proceed safely in the vicinity of moving vehicular traffic as required. The PDBs were prepared over clean sheets of aluminum foil prior to being placed into each well. The team used a pry bar, socket wrench or pinhead hex wrench as needed to open each flush mount monitoring well cover plate, and a Masterlock #485 padlock key for the standard “stick-up” well completions. The team donned new Nitrile gloves for groundwater sample collection.

2. The team carefully hauled each weighted PDB to the surface using the nylon suspension line. The sampling team carefully cut the top corner off each PDB and filled each sample vial. The team filled each vial just to overflowing and maintained a reverse meniscus. There was no down time once the PDB has been brought to the surface until sample collection was complete at each well. Any residual sample water in the used PDBs was discharged to ground surface.

3. Each PDB represented a unique sample ID number based on the well ID (and sample interval if two PDBs are deployed into one well). With the exception of the MS/MSD, all QC samples were submitted “blind” to the laboratory using a separate unique sample ID number not labeled as duplicate or trip blank per USACE standard sampling procedure. Trip blanks were required one per cooler. An extra laboratory- prepared PDB was shipped to the site and was used for collection of the trip and field blanks at the direction of the USACE project chemist.

4. Once recovered and sampled the PDBs and suspension lines were be discarded as non-hazardous municipal waste. In addition, gloves, paper towels, bags, and other solid waste materials were disposed of as municipal waste. The PDBs and other solid waste material were placed into a large plastic garbage bag and tied securely prior to disposal. The stainless steel weights were decontaminated and returned to the Seattle District, USACE office.

5. Finally, the team securely capped and locked each monitoring well riser and cover plate when finished.

2.6 Sampling Event Activities and Observations

2.6.1 Team 1 Private Well Sampling

Due to the large number of private wells selected for sample collection during June 2014, two sampling teams were sent to the field simultaneously along the monitoring well sampling team. Team 1 consisted of Blair Kinser and Rebecca Weiss. They were tasked with groundwater sample collection from 33 private well systems. During the period of 23-26 June 2014, Team 1 collected water samples from residential wells: WP-10, WP-25W, WP-27, WP-28, WP-45,

WP-50, WP-57, WP-65, WP-71A, WP-71B, WP-74, WP-82, WP-105, WP-111, WP-118, WP-119, WP-120, WP-122, WP-127, WP-128, WP-129, WP-144, WP-145, WP-152, WP-153, WP-154, WP-155, WP-165, WP-167, WP-168, WP-169, WP-177 and WP-179.

All required 40 ml VOA sample vials were obtained from Vendor ESS by the USACE contract lab ARI, and delivered to USACE pre-preserved with maleic and ascorbic acid.

Trip blanks were sent with every cooler delivery to the analytical lab. Due to the presence of containerized petroleum products nearby (fuel odors), a field blank sample was collected near the water tap sampling point at WP-177 using reagent-grade water.

Even though a right of entry permit has been signed, and verbal or written permission granted to collect samples at each designated location, the sampling team always attempted to contact the owner or resident at each private well location before beginning the field sampling activities. Upon arrival at each sampling point (hose bib, or suitable water discharge port nearest to the wellhead), the sampling team verified they were at the correct sample location, and attached a "T" tubing assembly to the sampling point. Water was allowed to flow at approximately one gpm into a capture bucket, while a separate stream was directed at a low flow rate (by regulating valve) to a flow cell by the tubing assembly per SOP. The water flow rate was measured using a graduated container, and the 15 minute purge timing was started. This and all other pertinent data was entered in the project field book.

Next, water quality parameters were monitored by Team 1 at a low flow rate of approximately 500 ml/min. to the flow cell while simultaneously allowing the continued unrestricted flow of water at approximately one gpm to a bucket by means of a "T" tubing assembly.

At each private well, low-flow purging continued until three consecutive measurements of the stabilization parameters met stabilization requirements. Purge readings across all 33 private wells stabilized within 6 to10 minutes. Measured temperatures ranged from 14.81 °C at WP-82 to 23.43° C at WP-65. Specific conductivity ranged from 0.22 ms/cm at WP-74 to 0.55 ms/cm at WP127. Dissolved oxygen measured from an extreme low of 0.12 ppm at WP-129 to 12.13 ppm at WP-28. PH ranged from 7.3 units at WP-119 to 8.13 units at WP-111. Oxygen reduction potential ranged widely from 14 mV at well WP-179, to 447 mV at well WP-65. Although turbidity is not a water chemistry parameter, it was still measured for project records. Turbidity ranged from 11NTU at WP-169 to 57.4 NTU at WP-45. The higher value was likely caused by significant air bubbles in the flow cell at WP-45 as the water appeared visually clear.

Upon achieving stabilization, the final stabilized readings were entered into the project field book, and the team continued purging well water until the 15 minutes had elapsed. At most locations, a minimum of 15 to 20 gallons were purged.

Prior to collecting a water sample, the flow rate at each tap was reduced to approximately 100 to 200 ml/min. to minimize sample aeration and turbulence. The sampling team donned new Nitrile gloves prior to sample collection at each residence. All sample containers were be filled with water directly from each tap – forming a meniscus at the top of each vial to provide zero headspace samples as required. Sample point locations (by field notations and GPS receiver derived coordinates) were recorded as required to assist in data interpretation and future field sampling efforts. A photographic record of each sample point was made by the team.

Significant or unusual observations made by Private Well Sampling Team 1

Door handle tags were attached to the following front doors of eight homes where private wells were sampled by USACE sampling Team 1, but the resident was not at home during sample collection: WP-45, WP-82, WP-111, WP-122, WP-128, WP-144, WP-145, and WP-152. The door handle tags are intended to inform the residents that a sample had been collected by the USACE team while they were away from home, and provide them with a point of contact and phone number if they had any questions or concerns. Photos of the handle tags are maintained in USACE project files and are found at Appendix B.

The team experienced difficulty using the flow cell and associated tubing at WP-165 due to the oversized discharge port (2 inch). Normally, 5/8-inch hose bibs were used for sample collection.

At WP-177 the resident provided a letter to Team 1 requesting sample results for all valley wells to be sent to the landowner. Also, the well at WP-177 was reported to be shallow and provided turbid samples. The well house sample location held fuel containers that emitted a fuel odor requiring the team collect a field blank at this location.

The address at WP-25W was incorrect on the team spreadsheet. The team was able to verify and correct the address in the field to assist future sampling events at this location.

The team reported several of the WHF well houses are now fitted with lock boxes to allow USACE team entry if the resident is away from home. Recommend the project team ensure all future sampling teams are informed of the combination to those lock boxes.

The team suspected many of the turbidity readings were biased high due to excessive air bubbles in the flow cell possibly created by the “Tee” tubing assembly.

Between 23 and 26 June 2014, all Team 1 groundwater samples were shipped priority overnight to Analytical Resources, Inc. via the Grant County Airport Fedex Station. Sampling Team 1departed project site on 26 June 2014 and returned to the USACE District Office in Seattle.

2.6.2 Team 2 Private Well Sampling

While private well Team 1 worked independently on their set of private wells, Team 2 collected samples at their own pre-determined set of 35 private well systems. Team 2 consisted of David Sullivan and Karah Haskins. During the period of 23-26 June 2014, Team 2 collected water samples from the following private well systems: WP-03; WP-04; WP-09, WP-13E; WP-18N; WP-18S; WP-33; WP-52; WP-54; WP-66; WP-68; WP-69; WP-116; WP-121(WHF system); WP-123; WP-124; WP-125; WP-126; WP-130; WP-131; WP-136; WP-138; WP-139; WP-143; WP-147; WP-148; WP-149; WP-150; WP-151; WP-156; WP-164; WP-172; WP-175; WP-178; and WP-180.

All required 40 ml VOA sample vials were obtained from Vendor ESS by the USACE contract lab ARI, and delivered to USACE pre-preserved with maleic and ascorbic acid.

Trip blanks were sent with every cooler delivery to the analytical lab.

Even though a right of entry permit has been signed, and verbal or written permission granted to collect samples at each designated location, the sampling team always attempted to contact the owner or resident at each private well location before beginning the field sampling activities. Upon arrival at each sampling point (hose bib, or suitable water discharge port nearest to the wellhead), the sampling team verified they were at the correct sample location, and attached a "T" tubing assembly to the sampling point. Water was allowed to flow at approximately one gpm into a capture bucket, while a separate stream was directed at a low flow rate (by regulating valve) to a flow cell by the tubing assembly per SOP. The water flow rate was measured using a graduated container, and the 15 minute purge timing was started. This and all other pertinent data was entered in the project field book.

Next, water quality parameters were monitored by Team 2 at a low flow rate of approximately 200 to 400ml/min. to the flow cell while simultaneously allowing the continued unrestricted flow of water at approximately one gpm to a bucket by means of a "T" tubing assembly.

At each private well, low-flow purging continued until three consecutive measurements of the stabilization parameters met stabilization requirements. Purge readings across all 35 private wells stabilized within 8 to10 minutes. Measured temperatures ranged from 15.04 °C at WP-185 to 22.58° C at WP-121. Specific conductivity ranged from an extreme low of 0.03 ms/cm at WP-09 to 0.37 ms/cm at WP123. Dissolved oxygen measured from a low of 0.56 ppm at WP-121 to 9.67 ppm at WP-185. PH ranged from 6.71 units at WP-121 to 7.95 units at WP-178. Oxygen reduction potential ranged widely from 319 mV at well WP-116, to 755 mV at well WP-164. Although turbidity is not a water chemistry parameter, it was still measured for project records. Turbidity ranged from 6.3 NTU at WP-123 to 53.4 NTU at WP-116.

Upon achieving stabilization, the final stabilized readings were entered into the project field book, and the team continued purging well water until the 15 minutes had elapsed. At most locations, a minimum of 15 to 20 gallons were purged.

Prior to collecting a water sample, the flow rate at each tap was reduced to approximately 100 to 200 ml/min. to minimize sample aeration and turbulence. The sampling team donned new Nitrile gloves prior to sample collection at each residence. All sample containers were be filled with water directly from each tap – forming a meniscus at the top of each vial to provide zero headspace samples as required. Sample point locations (by field notations and GPS receiver derived coordinates) were recorded as required to assist in data interpretation and future field sampling efforts. A photographic record of each sample point was made by the team

Significant or unusual observations made by Private Well Sampling Team 2

Door handle tags were attached to the following front doors of 16 homes where private wells were sampled by USACE Sampling Team 2, but the resident was not at home during sample collection: WP-03, WP-09, WP-52, WP-66, WP-68, WP-69, WP-126, WP-136, WP-147, WP-148, WP-149, WP-150, WP-151, WP-156, WP-172, and WP-175. As mentioned previously, the door handle tags are intended to inform the residents that a sample had been collected by the USACE team while they were away from home, and provide them with a point of contact and phone number if they had any questions or concerns. Photos of the handle tags are maintained in USACE project files and are found at Appendix B.

Due to the presence of containerized chemicals near the sample point, one field blank sample was collected at WP-13E using reagent-grade water.

The team recommended review of ownership of WP-54 (b) (6) [redacted]
(b) (6) [redacted]

The team suspected many of the turbidity readings (e.g. WP-116) were biased high due to excessive air bubbles in the flow cell possibly created by the "Tee" tubing assembly.

Between 23 and 26 June 2014, all Team 2 groundwater samples were shipped priority overnight to Analytical Resources, Inc. via the Grant County Airport Fedex Station. Sampling Team 2 departed project site on 26 June 2014 and returned to the USACE District Office in Seattle.

2.6.3 USACE Teams 3 Monitoring Well Sampling

2.6.3.1 Passive Diffusion Bag Sampling

Even though a right of entry permit has been signed, and verbal or written permission granted to collect samples at each designated location, the sampling team always attempted to contact the owner or resident at each monitoring well location before beginning the field sampling activities.

Prior to conducting the June 2014 field sampling event, Joseph Marsh and David Sullivan deployed PDB assemblies into 35 monitoring wells selected for groundwater sampling that did not contain dedicated bladder pumps. By installing all diffusion bags at this time, the minimum required 14 day in-well time prior to sample collection would be met. Two sizes of PDBs were ordered: The bags consisted of the standard 220 ml size, and a larger 330 ml bag selected to accommodate primary and field duplicate samples where required. In some wells, two 330 ml PDBs were connected in tandem and lowered to the mid-screen depth to accommodate primary, field duplicate, and MS/MSD sample volumes as required. Two PDBs were installed at two mid-screen depths if a designated well had two screened intervals (as found in wells 04CW07, 12BW03, and 12BW04). All PDBs and stainless steel anchor weights were purchased from ALS Environmental, and shipped to the District office by UPS overnight delivery.

Following the established PDB deployment procedures, both environmental team members worked together using a table of Moses Lake monitoring well logs to determine the number of required weights, length of nylon suspension line, and number of PDBs required at each designated well. Wells deeper than 200 feet generally required two steel weights to allow proper PDB positioning. Each team member donned a new pair of Nitrile gloves prior to working on PDB assemblies at each well. Steel weights, suspension lines, and PDBs were quickly assembled on a strip of clean aluminum foil on the tailgate of the sampling vehicle. The prepared assembly of PDB, suspension lines, and weights was lowered into place at each well within 10 to 15 minutes to reduce the possibility of contaminants entering the diffusion bags during deployment.

At each specific well, the team lowered the weight into the well first, followed by the suspension line and PDB. The team worked to keep the assembly centered within the well casing as they slowly lower it to the well bottom. When the team felt the weight hit well bottom, they pulled up the line approximately one inch and tied it off securely to the casing plug or well cap. This method ensured the PDB would always be centered at the mid-well screen depth. Finally, the well cap was locked, or the cover plate secured with locking bolts depending on type of well encountered – stick up or flush mount.

All laboratory-filled PDBs arrived at the USACE office in good condition prior to field deployment. Each PDB was packed in groups of 10 into sealed foil pouches to prevent inadvertent contamination until deployment into the designated monitoring wells. No specific difficulties or problems were noted during PDB deployment.

The USACE monitoring well sampling team consisting of Joseph Marsh and Matt Brookshier completed the PDB and bladder pump sample collection during the June 2014 field sampling event. Sampling was initiated after first ensuring a minimum of 14 days had elapsed before returning to the Site for PDB sample collection. The team worked from the north end of the Site and moved to the far south end sampling each designated well as it was encountered. A total of 35 monitoring wells were fitted with PDBs. The PDB wells were: 02-BW01; 04-BW01; 04-BW04; 04-BW05; 04-BW06; 04-BW07; 04-BW09; 04-CW01; 04-CW02; 04-CW03; 04-CW04; 04-CW05; 04-CW07; 04-CW08; 12-BW01; 12-BW02; 12-BW03; 12-BW04; 12-BW05; 12-BW06; 12-BW07; 12-BW08; 12-CW01; 12-CW02; 12-CW03; 12-CW04; 12-CW05; 12-EX01; 12-EX02; 14BW01, 14BW02, 14BW03, 14EX03, 14EX04, and 14EX05.

All required 40 ml VOA sample vials were obtained from Vendor ESS by the USACE contract lab ARI, and delivered to USACE pre-preserved with maleic and ascorbic acid.

The team first verified each monitoring well location and identification number with project maps and the sampling matrix. The team also verified that work could proceed safely in the vicinity of moving vehicular traffic or other physical, biological, or environmental hazards that may have been present near each monitoring well.

Each team member donned new Nitrile gloves for groundwater sample collection at each well. Once the wells were unlocked and opened, one team member lifted the well riser plug and began hauling the PDB to the surface.

Once each PDB was raised to the surface, the sampling team worked together to carefully cut the top corner off each bag using decontaminated steel scissors. Next, one person held the open sample vials and the other carefully and slowly tilted the bags - open side down - toward each open sample vial. The pre-preserved vials were filled just to overflowing to maintain a reverse meniscus. Then the vials were immediately capped making sure there were no bubbles or headspace per standard VOC sampling procedure. This entire sampling process can be completed within one minute to minimize loss of volatiles while preventing introduction of contaminants into the water from surface sources. After all required vials were filled; any residual sample water remaining in the used PDBs was discharged to ground surface. Therefore, no Investigation-derived waste (IDW) water was generated during this sampling event.

All PDB water samples were labeled after collection and placed on ice in a shipping cooler under chain of custody for overnight delivery to the analytical laboratory.

Significant Observations Made During Passive Diffusion Bag Sampling
There were few significant observations made during PDB sampling. All bags were completely full upon retrieval from each well – no leaks detected. The sampling team recommends protective mesh PDB sleeves be used in future sampling events in wells with steel risers due to a greater potential for damage to the PDB membranes (monitoring wells 12EX01, 12EX02, 14EX03, 14EX04, and 14EX05).

Once recovered and sample water removed, the PDBs and suspension lines were discarded as non-hazardous municipal waste. In addition, gloves, paper towels, bags, and other solid waste materials were disposed of as municipal waste. The PDBs and other solid waste material were placed into a large plastic garbage bag and tied securely prior to disposal. The stainless steel weights were decontaminated and returned to the Seattle District, USACE office for future reuse.

Finally, the sampling team closed and locked each monitoring well casing cover or secured the flush mount well cover plates when sample collection was completed at each location.

2.6.3.2 Bladder Pump Sampling
Groundwater sample collection commenced immediately after achieving stabilization of water quality parameters during low flow purging at each well using dedicated bladder pump systems as described previously. As with the PDB sampling, the sampling team worked from the far north end of the Site, moving to the far south end sampling each designated well as it was encountered. The team used 15 lb. compressed CO2 cylinders acquired from Oxarc in Moses Lake to drive the pump systems, airlines, pump controllers, and flow cells to conduct the sampling of dedicated bladder pumps. The teams collected groundwater samples from 36 monitoring wells fitted with dedicated bladder pumps. The bladder pump wells included: 91BW02; 91BW03; 91BW04; 92BW01; 92BW02; 99AW01; 99AW04; 99BW01; 99AW09; 99BW09; 99BW10; 99BW11; 99BW12; 99BW14, 99BW15, 99BW16; 99BW18; 00BW01; 00BW02; 00BW03; 00BW04; 00BW05; 00BW06; 00BW07; 00BW09; 00BW10; 00AW11; 00AW13; 00BW11; 00BW12; 00BW13; 00BW14; 00BW15; 00BW16; 01BW01; and 02BW02.

The team successfully operated and sampled the recently repaired dedicated bladder pump in monitoring well 00-BW14 located in the CDSI Transfer and Recycling Center. Wells 91-BW01 and 99-BW17 were designated for water level readings, but US Air Force aircraft operating near these wells made access unsafe.

Even though a right of entry permit has been signed, and verbal or written permission granted to collect samples at each designated monitoring well, the sampling team always attempted to contact the owner or resident at each monitoring well location before beginning the field sampling activities. This was essential for all eight Port of Moses Lake monitoring wells located within the restricted area of the Grant County Airport. A Port of Moses Lake escort must be assigned (arranged in advance of the field sampling) to accompany the sampling team to those eight monitoring wells on the airfield (identified as 00BW09, 00BW12, 00BW03, 00BW02, 00BW11, 91BW02, and 00BW06).

Prior to sample collection, the samplers donned protective eyewear and new, clean, Nitrile gloves to prevent exposure to contaminants and cross-contamination. All sample containers were filled immediately following purging by disconnecting the flow-through cell from the pump tubing system, and capturing water directly from the discharge end of the tubing. During sample collection, physical observations were recorded in the Micropurge/Low-Flow Sampling Log data forms.

All purge readings stabilized within 6 to 10 minutes. Measured temperatures ranged from 15.07°C at well 99AW04 to 21.67°C at well 99BW16. Specific conductivity ranged from 0.32 mS/cm (well 00BW13) to 0.68 ms/cm (well 00BW02). Dissolved oxygen was measurements ranged from 0.90 ppm (well 00BW11) to 10.01 ppm (well 00BW07). PH ranged from 6.95 units (well 02BW02) to 7.57 units (well 00BW07). Oxygen reduction potential ranged from 168 mV (well 99BW09) to 248 mV (well 91BW04).

Significant Observations Made During Bladder Pump Sampling

The team added one bag of bentonite chips to the deep, narrow void on the north side of the well riser in flush mount well 99BW12 in an effort to completely fill the void. After bentonite placement, the void was measured to be 11 feet deep. Additional bentonite will be placed into the void during the next sampling event at the direction of the project Geologist. The void may have been caused by removal of the drill casing during well installation. This condition is not known to have compromised the integrity of the well at this time.

The monitoring well sampling team used a rental Horiba U50 flow cell for water quality parameter readings. The turbidity sensor failed to operate normally resulting in a zero value for readings during purging at each well.

Monitoring well 00BW14 is situated in a deep vault approximately two feet below the asphalt pavement of the CDSI Transfer and Recycling Center. Due to large openings in the manhole cover, surface water and waste materials routinely fall through the manhole cover, filling the vault. The sampling team must clean out a significant volume of foul smelling standing water and sediment to access the sealed well cover plate. The team recommends replacing the manhole cover with a different model that won't allow debris to penetrate, or sealing the large openings with expanding foam material or some suitable, durable material to help keep the vault clear.

Some limited drawdown was observed during purging at 99AW01, and 99AW04. Significant drawdown was observed during purging at wells 00BW16, 99BW09, and 99BW18 requiring slowing the pumping rate to stabilize the water levels in each well.

The Teflon pump discharge tubing (two foot length) should be replaced in wells 99AW01, 00BW15, and 99BW10 due to kinks and cracking.

Well 99-BW16 shows bentonite heaved in the well casing – no corrective action recommended at this time.

Between 23 and 27 June 2014, all groundwater samples for the June 2014 monitoring well sampling event were shipped priority overnight to Analytical Resources, Inc. via the Grant County Airport Fedex Station. The final two sample coolers shipped on Friday were designated for Saturday delivery, and coordination was made with the lab to receive those samples on a nonbusiness day. The sampling team departed project site on the afternoon of 28 June 2014 and returned to the USACE District Office in Seattle.

2.5 Investigation-Derived Waste

No investigation-derived waste was generated during this sampling event. All residual PDB water or purged well water was transferred directly to ground surface on each property near the sample point.

3.0 PACKAGING AND SHIPMENT

As mentioned in the narrative of each sampling event, groundwater samples were packaged in shipping coolers on ice and under chain of custody for priority overnight shipping to the USACE contract laboratory Analytical Resources, Inc. via the Grant County Airport Fedex Station.

All sample shipping coolers were prepared for laboratory delivery in the following manner: Each cooler was lined (sides and bottom) with plastic "bubble-wrap" sheets for shock absorption. A large 30-gallon plastic garbage bag was then placed into the cooler to contain the sample water in the event of container breakage during shipment to the laboratories. The glass sample vials were labeled, placed into plastic zip-seal bags, and placed into foam shipping blocks or bubble-wrap bags for shock protection. All the samples were placed in the shipping coolers as indicated on the corresponding chain of custody forms. Gallon size plastic zipper bags of cubed ice bags were placed between and on top of the samples in each cooler to ensure maintenance of the required four degrees centigrade (plus/minus two degrees) sample preservation temperature. The completed chain of custody (COC) forms were placed in gallon size plastic zipper bags and taped to the inside of each cooler lid. Two custody seals were affixed to the outside of each cooler. The custody seals were placed so that the coolers could not be opened without breaking the seals. Each cooler was then securely sealed with fiber tape. The field team ensured drain plugs were securely taped inside and out to prevent possible water leakage.

The laboratory was informed of the sample delivery and ensured the samples were properly accepted and checked in upon receipt the following morning after the sample containers were shipped. All sample coolers and sample containers were accounted for at the contract laboratory following each shipment.

4.0 LABORATORY ANALYSIS

Chemical analyses performed on the samples were as follows: VOCs (Method 524.3).

5.0 DECONTAMINATION PROCEDURES

PDB weights, flow cells and associated tubing, water level indicator meters, and water volume measurement containers used by each team were decontaminated at the end of the project with an Alconox®-water solution followed by triple rinsing using distilled water in the USACE Geology Laboratory.

6.0 PROTECTION LEVEL

All sampling activities were conducted under Worker Protection Level D. For this project, personnel protective equipment included reflective safety vests, safety splash protection glasses, Nitrile gloves, and safety steel toe boots. New pairs of Nitrile gloves were donned prior to handling acid-preserved sample containers and between each unique private well sample point or monitoring well.

End of Field Sampling Report

September/October 2014 Field Sampling Report

Private Wells and Monitoring Wells Groundwater Sampling Field Report

September-October 2014 Field Sampling Event

Moses Lake Wellfield Superfund Site
Moses Lake, Washington

Field Investigation:
28 September through 5 October 2014
Report Prepared:
October 2014

By: Technical Services Branch

US Army Corps
of Engineers ®
Seattle District

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APPENDICES

1.0 BACKGROUND AND OBJECTIVE OF INVESTIGATION

1.1 BACKGROUND

The Moses Lake Wellfield Superfund Site is located between the Grant County Airport and the City of Moses Lake, Washington. The Site includes the former Larson Air Force Base (LAFB) property, Port of Moses Lake property and adjacent private properties affected by Site groundwater contamination. The Site is listed on the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980 National Priorities List (NPL) for Uncontrolled Hazardous Waste Sites.

The Moses Lake Wellfield Superfund Site is an area of approximately 15 square miles, which includes the former LAFB, commercial facilities, and residences. The former LAFB occupied approximately 9,607 acres three miles northwest of the City of Moses Lake. The United States Air Force was active at the site from 1942 until 1966. During 1988 and 1989, the Washington State Department of Health confirmed the presence of trichloroethylene (TCE) above the Federal Maximum Contaminant Level (MCL) in three City of Moses Lake municipal wells and two Skyline community wells. The Seattle District, US Army Corps of Engineers (USACE) completed a Remedial Investigation (RI) phase in 2003. Appendix A of this report shows the general location map and a site map.

During the course of the RI, several private wells were tested and found to be contaminated with TCE. In 2001, the USACE contracted installation of carbon filtration units – known as whole house filter systems (WHF) - at five of those wells. Several years of groundwater monitoring data has been evaluated since the original WHF systems were installed.

The final results of the Phase I RI released in a report in March 1993 indicated that TCE was consistently found in shallow alluvial and upper basalt (*a*-basalt) groundwater in the central area of the former base.

On October 14, 1992, the affected areas of the former LAFB and off-site down gradient areas, termed the "Moses Lake Wellfield Contamination", were listed on the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) of 1980 for Uncontrolled Hazardous Waste Sites. The former LAFB property is one part of the Moses Lake Wellfield Superfund Site; the site also includes the contaminant plume.

Chemical results from 1993 and 1994 combined with historical data indicated that TCE occurred in the central and southern portion of the former LAFB in alluvial and *a*-basalt groundwater. In 2004, USACE confirmed TCE contamination in the next lower basalt aquifer (c-basalt). As of 1995, the data suggest that more than one source may have contributed TCE to the alluvial and *a*-basalt groundwater in the central portion of the former LAFB.

In 1998, URS Greiner completed a sampling round of private water wells and wells for Class A and Class B water systems east, south and southwest of the previously known TCE plume. There were eight detections of TCE during this study. Four wells that were previously outside the plume extent were found to be above the detection limit.

1.2 Groundwater Sampling Event Summary and Objectives

In coordination with the US Environmental Protection Agency (USEPA) Region 10, the USACE environmental field team comprised of Joseph Marsh and Matt Brookshier deployed to conduct the September-October 2014 Moses Lake Wellfield groundwater sampling event during a single mobilization. The events described in this report involve USACE field teams verifying sample point locations; discussion of sampling techniques; recording groundwater observations; collection of groundwater samples; and shipping those samples by overnight delivery for laboratory analysis.

All of the work described in this report was accomplished in accordance with the Moses Lake Wellfield Superfund Site Quality Assurance Project Plan. In addition, the team followed the guidance presented in: the Seattle District, USACE Safety and Health Plan; USACE Safety Manual EM 385-1-1; Seattle District, USACE, Sampling Standard Operating Procedures (SOP) for environmental sampling.

The private wells and monitoring wells designated for sampling is displayed on maps found at Appendix A. These wells have been selected based on their down-gradient locations relative to the inferred flow direction of TCE-contaminated groundwater and validated sampling analytical data from previous monitoring events.

The September-October 2014 sampling event included groundwater sample collection from 35 dedicated bladder pump wells, 35 Passive Diffusion Bag (PDB) monitoring wells, eight of a planned nine WHF systems, and six of a planned eight private wells. The sampling event was conducted between 28 September and 5 October 2014.

The objectives of groundwater sampling at Moses Lake are to: 1) collect representative samples from designated private well systems and monitoring wells yielding data of known and sufficient quality to evaluate TCE concentrations and define existing TCE plumes; 2) to assure compliance with the requirements of USEPA; and 3) to make critical project - specific decisions based on the evaluated data.

2.0 DESCRIPTION OF WORK

2.1 Activities Prior to the September-October 2014 Groundwater Sampling Event

The USACE project team worked to collect signatures on Department of the Army Right of Entry forms as required before conducting the well sampling on private, city or county government property. For most properties, previously signed Right of Entry forms were still valid. For all properties designated for sample collection, owners (and renters if applicable) were contacted to coordinate sample collection times during the scheduled field sampling week. Many of the owners allowed the sampling teams to work on their property while they were not at home. At some of the properties, home owners or well system managers had to unlock pump houses and open valves for the sampling teams – requiring prior coordination.

Prior to conducting sampling activities at each location, both teams verified the address or well location and map location matched, and that the Right of Entry form had been signed prior to arriving at each sampling location.

The field team was responsible for identifying potential health and safety hazards at each sampling location. If a hazard is verified at a private well sampling location, an alternate hose bib connected to the same water source may be selected in a safer area of the subject property. In the case of hazardous monitoring well conditions, rescheduling the collection time or date when the hazards no longer exist may be required.

Also for private well sampling, the field team was tasked with determining the most appropriate cold-water tap or other sample port as close to each wellhead as practical, while comparing notes on sample points collected during previous sampling events. The team was briefed that groundwater samples would not be collected from taps delivering chlorinated, aerated, softened or filtered water.

2.2 Private Well Sampling Procedures

Per established standard operating procedure, private well purging flow rate has been established at approximately one gallon per minute (3.8 liters) maximum as verified by graduated cylinder or other suitable water measurement containers. During flow rate adjustments, the teams monitored the surrounding area and flowing water for unusual observations and odors as purge water is captured in a five gallon purge water bucket. They recorded the start time of the 15 minute purging in the field logbook immediately after opening each hose bib sample point.

After recording brief observations at each private well from the opened sample point hose bib valve, the sample point valve was temporarily closed to allow connection of the flow cell inlet tubing assembly.

The flow cell inlet port was connected to the designated sample point (hose bib) using a specialized 'Tee" tubing assembly allowing well water to flow directly into the five gallon purge water bucket at a high flow rate while allowing well water to be conveyed directly to the flow cell at a lower flow rate as required to prevent instrument damage.

The sample point hose bib and flow control valve on the tubing assembly was slowly opened to a maximum measured flow rate not to exceed 500 ml/min. to avoid damaging the sensitive flow cell probes with excessive water pressure. Once that was achieved, the flow rate at the bypass tubing was measured and recorded in the field book along with the official purging start time.

As the water was observed flowing through the flow cell system and out into the purge bucket, each team would then record flow cell measurements in their field books every two minutes until the parameters stabilized. If stabilization occurred before the 15 minute total required purge time (as it did at every well), final stabilized measurements were recorded in the field book, and purging continued until 15 minutes total purge time had elapsed. At that time, the flow cell was powered down and the associated flow cell inlet tubing disconnected from the flow cell. Purged water continued to be captured in a five-gallon bucket through the bypass tubing at a rate of approximately one gpm.

After 15 minutes has elapsed, the sample point hose bib was shut off, and the tubing assembly removed to permit sampling directly from the hose bib. The approximate total purged volume and stabilized water quality readings were recorded in the project field book along with any other significant observations. The team then conducted the sample collection activities.

Prior to collecting a water sample, the team reduced the flow rate at each tap to approximately 150 to 200 ml/min. to minimize sample water turbulence and aeration. Prior to sample collection at each private well system, the samplers donned protective eyewear and new, clean, Nitrile gloves to prevent exposure to contaminants and cross-contamination. All groundwater samples were collected in pre-cleaned certified containers obtained from the analytical laboratory.

All sample containers were filled with water directly from each tap – forming a meniscus at the top of each vial to provide zero headspace samples as required. Sample point location and components of each plumbing system were noted to assist in data interpretation. A photographic record of each sample point was made by the team. In addition, each team placed handle tags (indicating that water samples were taken by USACE on that date and time) on the front doors of homes sampled if nobody was home during sample collection. A photo was taken of the handle tag and front of house in that case for the project files.

After the sample containers are filled, sample labels describing project, location, analysis, team members, preservative, sampling date, and collection time are placed on the containers. The samples are then packaged in bubble wrap bags and plastic zipper type bags, placed into pre-iced sample shipping coolers and prepared for shipment as described in Section 3.0. All field personnel worked to ensure each property was left just as they found it with no damage done, and any doors or gates closed as required.

2.3 WHOLE HOUSE FILTER SAMPLING PROCEDURES

In coordination with USEPA and affected Moses Lake area homeowners, granular activated carbon (GAC) water filters have been installed in private well systems showing TCE results of 3.5 µg/l or greater. Each GAC filter system consists of two lightweight composite GAC filter tanks (acting as lead and lag filters), associated piping, bag filters (to prevent GAC particles from entering the household plumbing system), pressure gauges and valved/regulated sample collection ports.

Each system was purged according to the current private well sampling SOP described in the following sections of this report. A hose bib nearest the well head was opened and a flow rate of approximately one gallon per minute (gpm) established as measured with graduated cylinder. The purged water was captured in a five gallon bucket and simultaneously directed at a lower flow rate into a flow cell to facilitate the collection of water quality parameter data consisting of temperature, specific conductivity, dissolved oxygen, pH, oxygen reduction potential, and turbidity. Once stabilization of these water quality parameters was achieved, the final readings were recorded and purging continued until 15 minutes had elapsed. The hose bib was closed and sampling commenced after 15 minutes of purging was completed at each location.

WHF sampling ports consist of three locations labeled “A” for the lead inlet port, “B” for the lead filter outlet port, and “C” for the lag filter outlet port.

WHF sample collection consists of opening each designated sample port valve fully to allow the maximum restricted flow rate of approximately 150 to 200 ml/min to flow into a capture bucket for a few seconds to ensure organic matter or air bubbles have been flushed out of the system. Restrictors have been placed on the sampling lines to provide a smooth, non-turbulent stream at a low-flow rate to minimize loss of volatiles that may be present in the water stream. Next, the sampling team immediately fills three pre-preserved VOA vials to zero headspace. New Nitrile gloves were donned before collecting samples at each port. All discharged water was directed into a five gallon plastic bucket for transfer to ground surface away from the shed or pump house GAC filter location after the samples were collected.

2.4 Monitoring Well Sampling Procedures

2.4.1 Monitoring Well Sampling Using Dedicated Bladder Pumps

Moses Lake monitoring well groundwater purging and sampling was performed in accordance with the Seattle District’s Low-Flow Ground Water Purging and Sampling SOP, prepared in March 1999 and revised on 1 Sep 2009. Data generated during purging were recorded on the MicroPurge/Low-Flow Sampling Log forms (Appendix C).

The team verified each monitoring well location and identification number with project maps and tables. They verified work can proceed safely in the vicinity of moving vehicular traffic, heavy industry, and other hazards as required. The team used a pry bar, socket wrench or pinhead hex wrench as needed to open each flush mount monitoring well cover plate, and a Masterlock #485 padlock key for the standard “stick-up” well completions. Prior to purging each well, the depth to static water level in each well was measured and checked periodically to monitor draw down as a guide to flow rate adjustment (no greater than 0.4 foot drawdown is permitted to prevent sampling stagnant casing water).

Purging operations at each well commenced once the following equipment was prepared: the MP20 MicroPurge® Controller equipped with an adjustable pressure regulator was connected to the Well Wizard® bladder pumps via air line and quick connect fittings. Another air line was quick-connected to a pressurized CO_2 cylinder to drive the pump. Pump flow rates were then adjusted during a “pre-purge” period to maximize withdrawal rates and minimize excessive drawdown in each well. The evacuated pre-purge volume at each well was intended to flush out a bladder pump and tubing volume prior to monitoring stabilization parameters. Finally, a QED MicroPurge® basics MP20 Flow Cell was connected to the pump’s discharge line at ground surface to measure established stabilization parameters (pH, specific conductivity, temperature, DO, ORP, and turbidity).

Depth to water measurements during purging were monitored and recorded to verify that minimal drawdown occurred. A graduated measuring cup was used to determine the volume purged. Generally, acceptable low-flow rates are no greater than 500 milliliters per minute (ml/min.), and are typically closer to 400 ml/min. for the Well Wizard® bladder pump systems, depending upon the amount of water level drawdown detected during pumping at each well. Purge data was recorded on the micropurge logs every two minutes.

Low-flow purging continued until three consecutive measurements of the stabilization parameters met stabilization requirements.

Stabilization parameter requirements for all private well and bladder pump monitoring wells are as follows:

Temperature	+/- 0.2 ºC
Specific Conductivity	+/- 0.020 milisiemens/centimeter (mS/cm)
DO	+/- 0.2 milligrams/liter (mg/l)
pH	+/- 0.2 units
ORP	+/- 20 millivolts (mV)

At each monitoring well, groundwater sample collection would begin immediately after achieving stabilization of water quality parameters during low flow purging.

Prior to sample collection, the samplers donned protective eyewear and new, clean, Nitrile gloves to prevent exposure to contaminants and cross-contamination. All groundwater samples were collected in pre-cleaned certified containers obtained from the analytical laboratory.

All sample containers were filled immediately following purging by disconnecting the flow-through cell from the pump tubing system, and capturing water directly from the discharge end of the tubing. All sample containers were carefully filled at a low-flow rate to minimize agitation. During sample collection, significant physical observations were recorded in the Micropurge/Low-Flow Sampling Log data forms and project field book as needed.

After filling the sample containers, sample labels describing project, location, analysis, team members, preservative, sampling date, and collection time were placed on each container and the container was placed in a plastic zipper bag. The bagged sample vials were placed into bubble wrap bags. Finally, the filled sample containers were placed into pre-iced shipping coolers to begin sample cooling to the required 4° centigrade sample preservation temperature prior to shipment to the analytical laboratory. One set of trip blanks were required and included per sample shipping cooler.

At the conclusion of groundwater sampling at each well, the flush mount well covers were bolted closed and stick up well caps padlocked.

2.4.2 Monitoring Well Sampling Using Passive Diffusion Bags

Passive diffusion bags were been selected by the Moses lake Project Delivery Team as the most appropriate, cost-effective method for groundwater sample collection from Moses Lake monitoring wells lacking dedicated bladder pumps. The PDBs were purchased from ALS Environmental laboratory under license by the US Geological Survey and The General Electric Company, both co patent-holders. The 1 ¼" diameter low-density polyethylene PDBs were pre-filled with 220 ml or 330 ml of ASTM Type II certified, laboratory-grade, deionized water. Each filled PDB was then heat sealed by the laboratory prior to shipment to USACE via overnight delivery in hermetically sealed pouches.

The environmental field team allowed a minimum of 14 days to elapse before returning to the Moses Lake site for groundwater sample collection per PDB guidance. PDB retrieval and sampling consisted of the following procedures:

1. The team verified each monitoring well location and identification number with project maps and the sample matrix. They verified work can proceed safely in the vicinity of moving vehicular traffic as required. The PDBs were prepared over clean sheets of aluminum foil prior to being placed into each well. The team used a pry bar, socket wrench or pinhead hex wrench as needed to open each flush mount monitoring well cover plate, and a Masterlock #485 padlock key for the standard "stick-up" well completions. The team donned new Nitrile gloves for groundwater sample collection.

2. The team carefully hauled each weighted PDB to the surface using the nylon suspension line. The sampling team carefully cut the top corner off each PDB and filled each sample vial. The team filled each vial just to overflowing and maintained a reverse meniscus. There was no down time once the PDB has been brought to the surface until sample collection was complete at each well. Any residual sample water in the used PDBs was discharged to ground surface.

3. Each PDB represented a unique sample ID number based on the well ID (and sample interval if two PDBs are deployed into one well). With the exception of the MS/MSD, all QC samples were submitted "blind" to the laboratory using a separate unique sample ID number not labeled as duplicate or trip blank per USACE standard sampling procedure. One set of trip blanks were required and included per sample shipping cooler. An extra laboratory- prepared PDB was shipped to the site and was used for collection of the trip and field blanks at the direction of the USACE project chemist.

4. Once recovered and sampled the PDBs and suspension lines were be discarded as non-hazardous municipal waste. In addition, gloves, paper towels, bags, and other solid waste materials were disposed of as municipal waste. The PDBs and other solid waste material were placed into a large plastic garbage bag and tied securely prior to disposal. The stainless steel weights were decontaminated and reused for deployment of new, replacement PDBs in selected monitoring wells.

5. Finally, the team securely capped and locked each monitoring well riser and cover plate when finished.

2.5 Sampling Event Activities and Observations

2.5.1 Monitoring Well Bladder Pump Sampling

Groundwater sample collection commenced immediately after achieving stabilization of water quality parameters during low flow purging at each well using dedicated bladder pump systems as described previously. As with the PDB sampling, the field team generally worked from the far north end of the Site, moving to the far south end sampling each designated well as it was encountered. The project well maps and sample matrix were used to ensure samples were collected at the correct locations. The team used 15 lb. (and occasionally 5 lb.) compressed CO_2

cylinders acquired from Oxarc in Moses Lake to drive the pump systems, airlines, pump controllers, and flow cells to conduct the sampling of dedicated bladder pumps.

During the September-October 2014 sampling event, the environmental field team collected groundwater samples from 35 of a planned set of 36 monitoring wells fitted with dedicated bladder pumps. Bladder pump well 00BW04 could not be sampled due to construction on the well and at the well location. The bladder pump wells designated for sample collection were: 91BW02; 91BW03; 91BW04; 92BW01; 92BW02; 99AW01; 99AW04; 99AW09; 99BW01; 99BW09; 99BW10; 99BW11; 99BW12; 99BW14, 99BW15, 99BW16; 99BW18; 00AW11; 00AW13; 00BW01; 00BW02; 00BW03; 00BW04; 00BW05; 00BW06; 00BW07; 00BW09; 00BW10; 00BW11; 00BW12; 00BW13; 00BW14; 00BW15; 00BW16; 01BW01; and 02BW02.

Even though a right of entry permit has been signed, and verbal or written permission granted to collect samples at each designated monitoring well, the sampling team always attempted to contact the property owner for each monitoring well location before beginning the field sampling activities. This was essential to conduct groundwater sampling, water level measurement, or inspection of ten designated monitoring wells located within the restricted area of the Grant County Airport (Port of Moses Lake property). A Port of Moses Lake escort must be assigned (arranged in advance of the field sampling) to accompany the sampling team to any location on the airfield. Airport monitoring wells designated for sampling, water level measurement, or inspection for future sampling consisted of: 00BW12, 91AW16, 00BW03, 00BW02, 00BW11, 91AW15, 91BW02, 00BW08, 00BW06, and 91AW13. During this sampling event, Port Security Manager Greg Becken acted as primary escort during airport property sampling on 18 November 2014. Environmental field work was completed as planned on that day. However, monitoring well 91AW13 could not be located for inspection during this event.

Other than property owner notifications, no special access procedures were required for any of the other bladder pump monitoring wells sampled during the September-October 2014 event.

Prior to sample collection, the samplers donned protective eyewear and new, clean, Nitrile gloves to prevent exposure to contaminants and cross-contamination. All sample containers were filled immediately following low-flow purging by disconnecting the flow-through cell from the pump tubing system, and capturing pumped groundwater directly from the discharge end of the pump tubing. During sample collection, physical observations were recorded in the Micropurge/Low-Flow Sampling Log data forms.

Stabilization of water quality parameters during purging occurred within three to seven readings (6 to 12 minutes) during this event. Measured temperatures ranged from 11.99°C at well 00BW03 to 15.17°C at well 91BW02. Specific conductivity ranged from 0.24 mS/cm (well 99BW09) to 0.53 ms/cm (well 00BW10). Dissolved oxygen measurements ranged from 1.35 ppm (well 00BW11) to 10.13 ppm (well 00BW12). PH ranged from 5.93 units (well 00BW13) to 7.08 units (well 00AW11). Oxygen reduction potential ranged from 206 mV (well 99BW12) to 649 mV (well 91BW04).

Significant Observations Made During Bladder Pump Sampling

Bladder pump monitoring well 00BW04 could not be accessed for groundwater sampling during the September-October 2014 sampling event. Monitoring well 00BW04 is situated in an active road construction zone and is being converted from stick-up casing to flush mount vault. This new access road has been installed for Genie Industries adjacent to the Grant County Airport. The dedicated bladder pump system was removed by USACE to permit construction of the well conversion by drilling contractor, and will be adjusted and re-installed in well 00BW04 during a future sampling event so that groundwater sampling can resume at this location.

Earlier in 2014, a deep, narrow void was observed in soils adjacent to the north side of the PVC riser in flush mount well 99BW12. At the direction of the project geologist, four bags of bentonite chips were added during this sampling event. However, a portion of the void remains requiring additional bentonite chips to be added in future events to seal the void space to ground surface inside the vault. The void is not believed to have compromised the integrity of the well.

Monitoring well 00BW14 is situated in a deep vault approximately two feet below the asphalt pavement of the CDSI Transfer and Recycling Center. Sampling teams must spend considerable time and effort to clean out several inches of water, sediment, and debris over the sealed well cover plate that has passed through the numerous openings in the manhole cover. After cleaning out the deep vault during the September-October 2014 sampling event, the team filled the manhole cover holes with expanding foam to keep water and debris out for future sampling events.

Significant drawdown was observed during purging at the following five wells: 99BW09, 99BW10, 99BW18, 00BW16, and 02BW02. In each case, the field team reduced the flow rate to arrest the drawdown- and partial recovery was observed prior to sample collection. Minor drawdown was observed at wells 99AW04, 00BW11, and 01BW01, but did not exceed the 0.4 ft. limitation of the low-flow SOP.

Well 99-BW16 shows bentonite heaved in the well casing – no corrective action recommended at this time.

For sampling Genie Industries bladder pump well 00BW09 – this well is no longer accessible from the airport side. The field team was required to check in with Genie personnel to obtain visitor badges, and be permitted to drive onto Genie property to access the well. During the September-October 2014 event, a Genie Facility Manager escorted the field team to the well for the groundwater sample collection. In addition, the vicinity of 00BW09 is being used for testing new mobile boom vehicles, so the team had to protect themselves from noise and constantly monitor moving equipment near the sampling zone.

Between 29 September and 4 October 2014, groundwater samples for this sampling event were shipped under chain of custody in a total of six coolers. The coolers were shipped via the Grant County Airport Fedex Station priority overnight to the contract laboratory - Analytical Resources, Inc. in Tukwila, WA.

The environmental field team departed the Site on 5October, 2014 after completing the groundwater sampling fieldwork. They hand-delivered the last two sample coolers under chain of custody to the contract laboratory, and returned to the USACE District Office in Seattle.

2.5.2 Private Well System Sampling

During the September-October 2014 groundwater sampling event, samples were collected from a total of 14 private wells consisting of: six private well system hose bibs (WP-04, WP-27, WP-125, WP-131, WP-167, and WP-168), and eight WHF systems (WP-14, WP-70, WP-83, WP-86, WP-121, WP-123, WP-124, and WP-129). Private wells WP-88 and WP-137 and WHF system WP-119 were scheduled for sample collection during this event, but power was turned off at those properties and water samples could not be obtained.

All required 40 ml VOA sample vials were obtained from Vendor ESS by the USACE contract lab ARI, and delivered to USACE pre-preserved with maleic and ascorbic acid.

Even though a right of entry permit has been signed, and verbal or written permission granted to collect samples at each designated location, the sampling team always attempted to contact the owner or resident at each private well location before beginning the field sampling activities. Upon arrival at each private well property designated for sample collection, the team verified they were at the correct address using maps, notes, and the sampling matrix, and verified through field documentation they were ready to collect samples at the correct sampling point (hose bib, or suitable water discharge port nearest to the wellhead.

Final stabilized flow cell readings for all private and WHF wells (except at WP-27 and WP-70 where the flow cell could not be used due to well system configuration) are shown below.

Table 1: Private Well Stabilized Water Quality Readings, Sep-Oct 2014

WELL	TEMP.°C	SpC mS/cm	D.O.	PH	ORP
WP-14	20.35	0.52	0.33	7.33	164
WP-83	11.70	0.49	0.30	7.08	202
WP-86	11.10	0.48	2.17	6.99	458
WP-119	11.58	0.31	0.28	7.14	320
WP-121	8.72	0.31	0.25	7.74	235
WP-123	11.46	0.31	2.86	7.23	388

WP-124	10.63	0.31	2.54	7.28	370
WP-125	10.56	0.31	7.85	7.66	331
WP-129	15.10	0.34	0.30	7.46	590
WP-131	11.63	0.33	6.33	7.82	579
WP-167	14.09	0.32	7.59	7.73	405
WP-168	12.64	0.36	5.73	7.73	394

Special coordination was made with (b) (6) [redacted], owner/operator of the multiple-home water system at WP-27 to arrange for system operation and sample collection at a specific time and date.

At the WHF locations, initial and post-sampling flow meter readings were recorded in the project field book. Upon achieving stabilization, the final stabilized readings were entered into the project field book. Prior to collecting a water sample, the flow rate at each tap was reduced to approximately 100 to 200 ml/min. to minimize sample aeration and turbulence. The sampling team donned new Nitrile gloves prior to sample collection at each residence. In the case of the WHF sample ports, restrictors on the sample ports provided a stream of sample water at approximately 150 to 200 ml/min. All sample containers were be filled with water directly from each tap – forming a meniscus at the top of each vial to provide zero headspace samples as required. A photographic record of each sample point was made by the team.

All required 40 ml VOA sample vials were obtained from Vendor ESS by the USACE contract lab ARI, and delivered to USACE pre-preserved with maleic and ascorbic acid.

Trip blanks were sent inside each sample shipping cooler delivered to the analytical lab.

Significant or unusual observations made during Private Well Sampling

Door handle tags were attached to the front doors of the following residences where private wells were sampled (or sampling could not be conducted), but the resident was not at home during sample collection activities: WP-70, WP-83, WP-86, WP-88, WP-119, WP-121, WP-123, WP-129, and WP-137. As mentioned previously, the door handle tags are intended to inform the residents that a sample had been collected by the USACE team while they were away from home, and provide them with a point of contact and phone number if they had any questions or concerns. Photos of the handle tags are maintained in USACE project files and are found at Appendix B.

At WP-86, the field team discovered [redacted] samples were collected. The team noted the flow restrictors on all three sample ports were marked 200 ml/min. flow, but delivered less than 150 ml/min. Recommend contractors replace the restrictors.

The field team attempted to locate WP-88 using the sampling map book, and private well documentation brought to the field. The team found the property location did not match the sample point location in the map book. Also, [redacted] No groundwater samples could be collected here, and a handle tag was left on the door indicating an attempt was made to collect samples.

As with WP-88, the field team discovered [redacted] at WP-119, and WP-137. [redacted] groundwater samples could not be collected. Handle tags were left on doors indicating an attempt was made to collect samples.

WP-129 [redacted] samples were collected at that location. A handle tag was left indicating a sample was collected.

Due to the presence of containerized chemicals near the well house sample points, one field blank sample was collected at WP-70 using reagent-grade water.

During sample collection at WP-124, sample port "B" was observed leaking at the valve/tubing interface (only when valve was opened) possibly due to faulty tubing installation. Recommend contractor make repairs to this sample port.

A clean six foot length of Teflon sample tubing was attached to the hose bib at WP-125 since that sample point was almost in contact with the floor, making sample collection difficult. In addition, the resident asked the field team to not let water run on the well house floor – another reason to attach the Teflon tubing. After decontamination, reagent grade water was passed through the tubing and collected as an equipment blank sample.

Between 29 September and 6 October 2014, seven coolers containing project groundwater samples were shipped priority overnight to Analytical Resources, Inc. via the Grant County Airport Fedex Station. The USACE environmental field team departed the project site on 6 October 2014, hand delivered the final two sample coolers to the project laboratory, and returned to the USACE District Office in Seattle.

2.5.3 Passive Diffusion Bag Sampling and Deployment

The USACE environmental field team collected samples from a pre-installed set of 35 PDB wells, and deployed new PDBs into those same monitoring wells during this sampling event. A total of 35 monitoring wells were fitted with new PDBs during the September-October 2014 sampling event in preparation for the November 2014 event. The PDB wells were: 02-BW01; 04-BW01; 04-BW04; 04-BW05; 04-BW06; 04-BW07; 04-BW09; 04-CW01; 04-CW02; 04-CW03; 04-CW04; 04-CW05; 04-CW07; 04-CW08; 12-BW01; 12-BW02; 12-BW03; 12-BW04; 12-BW05; 12-BW06; 12-BW07; 12-BW08; 12-CW01; 12-CW02; 12-CW03; 12-CW04; 12-CW05; 12-EX01; 12-EX02; 14BW01, 14BW02, 14BW03, 14EX03, 14EX04, and 14EX05.

All required 40 ml VOA sample vials were obtained from Vendor ESS by the USACE contract lab ARI, and delivered to USACE pre-preserved with maleic and ascorbic acid.

The team first verified each monitoring well location and identification number with project maps and the sample matrix. The team also verified that work could proceed safely in the vicinity of moving vehicular traffic or other physical, biological, or environmental hazards that may have been present near each monitoring well.

Each team member donned new Nitrile gloves for groundwater sample collection at each well. Once the wells were unlocked and opened, one team member lifted the well riser plug and began hauling the PDB vertically to the surface.

Once each PDB was raised to the surface, the sampling team worked together to carefully cut the top corner off each bag using decontaminated steel scissors. Next, one person held the open sample vials and the other carefully and slowly tilted the bags - open side down - toward each open sample vial. The pre-preserved vials were filled just to overflowing to maintain a reverse meniscus. Then the vials were immediately capped making sure there were no bubbles or headspace per standard VOC sampling procedure. This entire sampling process can be completed within one minute to minimize loss of volatiles while preventing introduction of contaminants into the water from surface sources. After all required vials were filled; any residual sample water remaining in the used PDBs was discharged to ground surface. Therefore, no Investigation-derived waste (IDW) water was generated during this sampling event.

The sampling team recommends continued use of protective mesh PDB sleeves in wells with steel risers due to a greater potential for damage to the PDB membranes (monitoring wells 12EX01, 12EX02, 14EX03, 14EX04, and 14EX05).

Once recovered and sample water removed, the PDBs and suspension lines were discarded as non-hazardous municipal waste. In addition, gloves, paper towels, bags, and other solid waste materials were disposed of as municipal waste. The PDBs and other solid waste material were placed into a large plastic garbage bag and tied securely prior to disposal. The stainless steel weights were decontaminated and returned to the Seattle District, USACE office for future reuse.

Finally, the sampling team closed and locked each monitoring well casing cover or secured the flush mount well cover plates when sample collection was completed at each location.

After collecting water samples from the PDBs, the team deployed new PDB assemblies back into the same 35 monitoring wells selected for the next groundwater sampling event.

Two sizes of PDBs were ordered: The bags consisted of the standard 220 ml size, and a larger 330 ml bag selected to accommodate primary and field duplicate samples where required. In some wells, two 330 ml PDBs were connected in tandem and lowered to the mid-screen depth to accommodate primary, field duplicate, and MS/MSD sample volumes as required. Two PDBs were installed at two mid-screen depths if a designated well had two screened intervals (as found in wells 04CW07, 12BW03, and 12BW04). All PDBs and stainless steel anchor weights were purchased from ALS Environmental, and shipped to the District office by UPS overnight delivery.

Following the established PDB deployment procedures, both environmental team members worked together using a table of Moses Lake monitoring well logs to determine the number of required weights, length of nylon suspension line, and number of PDBs required at each designated well. Wells deeper than 200 feet generally required two steel weights to allow proper PDB positioning. Each team member donned a new pair of Nitrile gloves prior to working on PDB assemblies at each well. Steel weights, suspension lines, and PDBs were quickly assembled on a strip of clean aluminum foil on the tailgate of the sampling vehicle. The prepared assembly of PDB, suspension lines, and weights was lowered into place at each well within 10 to 15 minutes to reduce the possibility of contaminants entering the diffusion bags during deployment.

At each specific well, the team lowered the weight into the well first, followed by the suspension line and PDB. The team worked to keep the assembly centered within the well casing as they slowly lower it to the well bottom. When the team felt the weight hit well bottom, they pulled up the line approximately one inch and tied it off securely to the casing plug or well cap. This method ensured the PDB would always be centered at the mid-well screen depth. Finally, the well cap was locked, or the cover plate secured with locking bolts depending on type of well encountered – stick up or flush mount.

All laboratory-filled PDBs arrived at the USACE office in good condition prior to field deployment. Each PDB was packed in groups of 10 into sealed foil pouches to prevent inadvertent contamination until deployment into the designated monitoring wells. No specific difficulties or problems were noted during PDB deployment.

Significant Observations Made During Passive Diffusion Bag Sampling

On 28 September 2014, the field team collected a field blank sample near PDB monitoring well 04CW03 due to petroleum odors near the old US Air Force tank farm. On 29 September 2014, two PDB blank samples were collected from random PDBs enclosed in two separate lots as delivered from the PDB laboratory. No unusual observations were made during PDB sampling.

3.0 INVESTIGATION-DERIVED WASTE

No investigation-derived waste was generated during this sampling event. All residual PDB water or purged well water was transferred directly to ground surface on each property away from the sample collection point.

4.0 PACKAGING AND SHIPMENT

As mentioned in the narrative of each sampling event, groundwater samples were packaged in shipping coolers on ice and under chain of custody for priority overnight shipping to the USACE contract laboratory Analytical Resources, Inc. via the Grant County Airport Fedex Station. Team 1 hand delivered one cooler directly to the laboratory at the conclusion of the sampling event.

All sample shipping coolers were prepared for laboratory delivery in the following manner: Each cooler was lined (sides and bottom) with plastic “bubble-wrap” sheets for shock absorption.

A large 30-gallon plastic garbage bag was then placed into the cooler to contain the sample water in the event of container breakage during shipment to the laboratories. The glass sample vials were labeled, placed into plastic zip-seal bags, and placed into foam shipping blocks or bubble-wrap bags for shock protection. All the samples were placed in the shipping coolers as indicated on the corresponding chain of custody forms. Gallon size plastic zipper bags of cubed ice bags were placed between and on top of the samples in each cooler to ensure maintenance of the required four degrees centigrade (plus/minus two degrees) sample preservation temperature. The completed chain of custody (COC) forms were placed in gallon size plastic zipper bags and taped to the inside of each cooler lid. Two custody seals were affixed to the outside of each cooler. The custody seals were placed so that the coolers could not be opened without breaking the seals. Each cooler was then securely sealed with fiber tape. The field team ensured drain plugs were securely taped inside and out to prevent possible water leakage.

The laboratory was informed of the sample delivery and ensured the samples were properly accepted and checked in upon receipt the following morning after the sample containers were shipped. All sample coolers and sample containers were accounted for at the contract laboratory following each shipment.

5.0 LABORATORY ANALYSIS

Chemical analyses performed on the samples were as follows: VOCs (Method 524.3).

6.0 DECONTAMINATION PROCEDURES

PDB weights, flow cells and associated tubing, water level indicator meters, and water volume measurement containers used by each team were decontaminated at the end of the project with an Alconox®-water solution followed by triple rinsing using distilled water in the USACE Geology Laboratory.

7.0 PROTECTION LEVEL

All sampling activities were conducted under Worker Protection Level D. For this project, personnel protective equipment included reflective safety vests, safety splash protection glasses, Nitrile gloves, and safety steel toe boots. New pairs of Nitrile gloves were donned prior to handling acid-preserved sample containers and between each unique private well sample point or monitoring well.

End of Field Sampling Report

APPENDIX B – Comprehensive 2014 Analytical Results

APPENDIX B – Comprehensive 2014 Analytical Results

			Analyte Name	1,1,1-TCA	1,1-DCA	1,1-DCE	1,2-DCA	cis-1,2-DCE	trans-1,2-DCE	TCE	VC
			CAS RN	71-55-6	75-34-3	75-35-4	107-06-2	156-59-2	156-60-5	79-01-6	75-01-4
			MCL	200 µg/l	5 µg/l	7 µg/l	5 µg/l	70 µg/l	100 µg/l	5 µg/l	2 µg/l
Well ID	Sample Name	Sample Type	Sample Date								
Monitoring Wells											
00AW11	14MLW0625N00AW11	N	6/25/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	1.05	0.20 U
00AW11	14MLW1004N00AW11	N	10/4/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	1.47	0.20 U
00AW13	14MLW0624N00AW13	N	6/24/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
00AW13	14MLW1005N00AW13	N	10/5/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
00BW01	14MLW0623N00BW01	N	6/23/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
00BW01	14MLW1001N00BW01	N	10/1/2014	0.20 U	0.20 U	0.20 UJ	0.20 U	0.20 U	0.20 U	0.20 U	0.20 UJ
00BW02	14MLW0624N00BW02	N	6/24/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.21	0.20 U
00BW02	14MLW0930N00BW02	N	9/30/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.19 J	0.20 U
00BW03	14MLW0624N00BW03	N	6/24/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
00BW03	14MLW0930N00BW03	N	9/30/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
00BW04	14MLW0623N00BW04	N	6/23/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
00BW04	14MLW0623D00BW04	FD	6/23/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
00BW05	14MLW0622N00BW05	N	6/23/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
00BW05	14MLW0930N00BW05	N	9/30/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 UJ
00BW05	14MLW0930D00BW05	FD	9/30/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 UJ
00BW06	14MLW0624N00BW06	N	6/24/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
00BW06	14MLW0930N00BW06	N	9/30/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
00BW07	14MLW0623N00BW07	N	6/23/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
00BW07	14MLW1001N00BW07	N	10/1/2014	0.20 U	0.20 U	0.20 UJ	0.20 U	0.20 U	0.20 U	0.20 U	0.20 UJ
00BW09	14MLW0624N00BW09	N	6/24/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
00BW09	14MLW0930N00BW09	N	9/30/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
00BW10	14MLW0626N00BW10	N	6/26/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
00BW10	14MLW1001N00BW10	N	10/1/2014	0.20 U	0.20 U	0.20 UJ	0.20 U	0.20 U	0.20 U	0.20 U	0.20 UJ
00BW11	14MLW0624N00BW11	N	6/24/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
00BW11	14MLW0930N00BW11	N	9/30/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
00BW12	14MLW0624N00BW12	N	6/24/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	15.6	0.20 U
00BW12	14MLW0930N00BW12	N	9/30/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	17.0	0.20 U
00BW13	14MLW0622N00BW13	N	6/22/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.13 J	0.20 U
00BW13	14MLW1004N00BW13	N	10/4/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U

			Analyte Name	1,1,1-TCA	1,1-DCA	1,1-DCE	1,2-DCA	cis-1,2-DCE	trans-1,2-DCE	TCE	VC
			CAS RN	71-55-6	75-34-3	75-35-4	107-06-2	156-59-2	156-60-5	79-01-6	75-01-4
			MCL	200 µg/l	5 µg/l	7 µg/l	5 µg/l	70 µg/l	100 µg/l	5 µg/l	2 µg/l
Well ID	Sample Name	Sample Type	Sample Date								
00BW14	14MLW0623N00BW14	N	6/23/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
00BW14	14MLW1001N00BW14	N	10/1/2014	0.20 U	0.20 U	0.20 UJ	0.20 U	0.20 U	0.20 U	0.20 U	0.20 UJ
00BW15	14MLW0625N00BW15	N	6/25/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.31	0.20 U	1.86	0.20 U
00BW15	14MLW1004N00BW15	N	10/4/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.25	0.20 U	1.74	0.20 U
00BW16	14MLW0624N00BW16	N	6/24/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
00BW16	14MLW1005N00BW16	N	10/5/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
01BW01	14MLW0622N01BW01	N	6/23/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
01BW01	14MLW0930N01BW01	N	9/30/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 UJ
02BW01	14MLW0626N02BW01	N	6/26/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	12.0	0.20 U
02BW01	14MLW0929N02BW01	N	9/29/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	10.8	0.20 U
02BW01	14MLW0929D02BW01	FD	9/29/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	11.2	0.20 U
02BW02	14MLW0623N02BW02	N	6/23/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
02BW02	14MLW1001N02BW02	N	10/1/2014	0.20 U	0.20 U	0.20 UJ	0.20 U	0.20 U	0.20 U	0.20 U	0.20 UJ
04BW01	14MLW062204BW01	N	6/22/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
04BW01	14MLW0928N04BW01	N	9/28/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
04BW04	14MLW0622N04BW04	N	6/22/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.45	0.20 U
04BW04	14MLW0928N04BW04	N	9/28/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.45	0.20 U
04BW05	14MLW0622N04BW05	N	6/22/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	1.70	0.20 U
04BW05	14MLW0928N04BW05	N	9/28/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	1.44	0.20 U
04BW06	14MLW0622N04BW06	N	6/22/2014	0.20 U	0.20 U	0.20 U	0.20 U	2.77	0.20 U	12.7	0.20 U
04BW06	14MLW0928N04BW06	N	9/28/2014	0.20 U	0.20 U	0.20 U	0.20 U	2.64	0.20 U	11.4	0.20 U
04BW07	14MLW0622N04BW07	N	6/22/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
04BW07	14MLW0929N04BW07	N	9/29/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
04BW09	14MLW0622N04BW09	N	6/22/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	25.1	0.20 U
04BW09	14MLW0929N04BW09	N	9/29/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	27.5	0.20 U
04CW01	14MLW0622N04CW01	N	6/22/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.48	0.20 U
04CW01	14MLW0622D04CW01	FD	6/22/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.46	0.20 U
04CW01	14MLW0928N04CW01	N	9/28/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.62	0.20 U
04CW02	14MLW0622N04CW02	N	6/22/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
04CW02	14MLW0928N04CW02	N	9/28/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
04CW03	14MLW0622N04CW03	N	6/22/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	2.47	0.20 U
04CW03	14MLW0928N04CW03	N	9/28/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	2.51	0.20 U

			Analyte Name	1,1,1-TCA	1,1-DCA	1,1-DCE	1,2-DCA	cis-1,2-DCE	trans-1,2-DCE	TCE	VC
			CAS RN	71-55-6	75-34-3	75-35-4	107-06-2	156-59-2	156-60-5	79-01-6	75-01-4
			MCL	200 µg/l	5 µg/l	7 µg/l	5 µg/l	70 µg/l	100 µg/l	5 µg/l	2 µg/l
Well ID	Sample Name	Sample Type	Sample Date								
04CW04	14MLW0622N04CW04	N	6/22/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.43	0.20 U
04CW04	14MLW0929N04CW04	N	9/29/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.41	0.20 U
04CW05	14MLW0627N04CW05	N	6/27/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	2.77	0.20 U
04CW05	14MLW0929N04CW05	N	9/29/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	2.69	0.20 U
04CW07	14MLW0626N04CW07A	N	6/26/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	4.83	0.20 U
04CW07	14MLW0626N04CW07B	N	6/26/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	5.73	0.20 U
04CW07	14MLW0929N04CW07A	N	9/29/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	5.22	0.20 U
04CW07	14MLW0929N04CW07B	N	9/29/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	5.60	0.20 U
04CW08	14MLW0622N04CW08	N	6/22/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
04CW08	14MLW0929N04CW08	N	9/29/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
12BW01	14MLW0622N12BW01	N	6/22/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
12BW01	14MLW0929N12BW01	N	9/29/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
12BW02	14MLW0627N12BW02	N	6/27/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	6.88 J+	0.20 U
12BW02	14MLW0627D12BW02	FD	6/27/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	8.55	0.20 U
12BW02	14MLW0929N12BW02	N	9/29/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	7.72	0.20 U
12BW03	14MLW0627N12BW03A	N	6/27/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.94	0.20 U
12BW03	14MLW0627N12BW03B	N	6/27/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.88	0.20 U
12BW03	14MLW0929N12BW03A	N	9/29/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.90	0.20 U
12BW03	14MLW0929D12BW03A	FD	9/29/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.75	0.20 U
12BW03	14MLW0929N12BW03B	N	9/29/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.59	0.20 U
12BW04	14MLW0622N12BW04A	N	6/22/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	17.4	0.20 U
12BW04	14MLW0622N12BW04B	N	6/22/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	17.5	0.20 U
12BW04	14MLW0929N12BW04A	N	9/29/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	18.8	0.20 U
12BW04	14MLW0929N12BW04B	N	9/29/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	17.8	0.20 U
12BW05	14MLW0622N12BW05	N	6/22/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	88.2 J-	0.20 U
12BW05	14MLW0929N12BW05	N	9/29/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	87.2	0.20 U
12BW06	14MLW0627N12BW06	N	6/27/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	5.96	0.20 U
12BW06	14MLW0929N12BW06	N	9/29/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	5.08	0.20 U
12BW07	14MLW0622N12BW07	N	6/22/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	60.1 J-	0.20 U
12BW07	14MLW0929N12BW07	N	9/29/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	64.6	0.20 U
12BW08	14MLW0627N12BW08	N	6/27/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	9.56	0.20 U
12BW08	14MLW0929N12BW08	N	9/29/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	8.28	0.20 U

			Analyte Name	1,1,1-TCA	1,1-DCA	1,1-DCE	1,2-DCA	cis-1,2-DCE	trans-1,2-DCE	TCE	VC
			CAS RN	71-55-6	75-34-3	75-35-4	107-06-2	156-59-2	156-60-5	79-01-6	75-01-4
			MCL	200 µg/l	5 µg/l	7 µg/l	5 µg/l	70 µg/l	100 µg/l	5 µg/l	2 µg/l
Well ID	Sample Name	Sample Type	Sample Date								
12CW01	14MLW0627N12CW01	N	6/27/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	3.54	0.20 U
12CW01	14MLW0627D12CW01	FD	6/27/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	3.52	0.20 U
12CW01	14MLW0929N12CW01	N	9/29/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	3.26	0.20 U
12CW02	14MLW0627N12CW02	N	6/27/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.11 J	0.20 U
12CW02	14MLW0929N12CW02	N	9/29/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.29	0.20 U
12CW03	14MLW0622N12CW03	N	6/22/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.32	0.20 U
12CW03	14MLW0929N12CW03	N	9/29/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.30	0.20 U
12CW04	14MLW0622N12CW04	N	6/22/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.51	0.20 U
12CW04	14MLW0929N12CW04	N	9/29/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.70	0.20 U
12CW05	14MLW0627N12CW05	N	6/27/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.93	0.20 U
12CW05	14MLW0929N12CW05	N	9/29/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.67	0.20 U
12EX01	14MLW0622N12EX01	N	6/22/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.59	0.20 U	4.65	0.20 U
12EX01	14MLW0929N12EX01	N	9/29/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.45	0.20 U	3.45	0.20 U
12EX02	14MLW0627N12EX02	N	6/27/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	5.03	0.20 U
12EX02	14MLW0929N12EX02	N	9/29/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	4.24	0.20 U
14BW01	14MLW0626N14BW01	N	6/26/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	46.2	0.20 U
14BW01	14MLW0929N14BW01	N	9/29/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	47.2	0.20 U
14BW02	14MLW0626N14BW02	N	6/26/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	20.5	0.20 U
14BW02	14MLW0929N14BW02	N	9/29/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	18.3	0.20 U
14BW03	14MLW0622N14BW03	N	6/22/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	12.2	0.20 U
14BW03	14MLW0929N14BW03	N	9/29/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	10.8	0.20 U
14EX03	14MLW0626N14EX03	N	6/26/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	45.0	0.20 U
14EX03	14MLW0929N14EX03	N	9/29/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20	0.20 U	39.1	0.20 U
14EX04	14MLW0626N14EX04	N	6/26/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	13.4	0.20 U
14EX04	14MLW0626D14EX04	FD	6/26/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	14.1	0.20 U
14EX04	14MLW0929N14EX04	N	9/29/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	17.8	0.20 U
14EX05	14MLW0622N14EX05	N	6/22/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	5.98	0.20 U
14EX05	14MLW0929N14EX05	N	9/29/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	5.47	0.20 U
14EX05	14MLW0929D14EX05	FD	9/29/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	5.53	0.20 U
91BW02	14MLW0624N91BW02	N	6/24/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
91BW02	14MLW0624D91BW02	FD	6/24/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
91BW02	14MLW0930N91BW02	N	9/30/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U

			Analyte Name	1,1,1-TCA	1,1-DCA	1,1-DCE	1,2-DCA	cis-1,2-DCE	trans-1,2-DCE	TCE	VC
			CAS RN	71-55-6	75-34-3	75-35-4	107-06-2	156-59-2	156-60-5	79-01-6	75-01-4
			MCL	200 µg/l	5 µg/l	7 µg/l	5 µg/l	70 µg/l	100 µg/l	5 µg/l	2 µg/l
Well ID	Sample Name	Sample Type	Sample Date								
91BW03	14MLW0625N91BW03	N	6/25/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	31.0	0.20 U
91BW03	14MLW0625D91BW03	FD	6/25/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	30.3	0.20 U
91BW03	14MLW1004N91BW03	N	10/4/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	32.3	0.20 U
91BW04	14MLW0625N91BW04	N	6/25/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.21	0.20 U
91BW04	14MLW1004N91BW04	N	10/4/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.18 J	0.20 U
91BW04	14MLW1004D91BW04	FD	10/4/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.19 J	0.20 U
92BW01	14MLW0625N92BW01	N	6/25/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	17.8	0.20 U
92BW01	14MLW1004N92BW01	N	10/4/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	21.2	0.20 U
92BW02	14MLW0625N92BW02	N	6/25/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.70	0.20 U	6.69	0.20 U
92BW02	14MLW1004N92BW02	N	10/4/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.86	0.20 U	7.70	0.20 U
99AW01	14MLW0625N99AW01	N	6/25/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.70	0.20 U
99AW01	14MLW1004N99AW01	N	10/4/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	1.10	0.20 U
99AW04	14MLW0627N99AW04	N	6/27/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
99AW04	14MLW1005N99AW04	N	10/5/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
99AW09	14MLW0626N99AW09	N	6/26/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	1.71	0.20 U
99AW09	14MLW1005N99AW09	N	10/5/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	1.94	0.20 U
99BW01	14MLW0625N99BW01	N	6/25/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	32.6	0.20 U
99BW01	14MLW1004N99BW01	N	10/4/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	32.2	0.20 U
99BW09	14MLW0626N99BW09	N	6/26/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
99BW09	14MLW1001N99BW09	N	10/1/2014	0.20 U	0.20 U	0.20 UJ	0.20 U	0.20 U	0.20 U	0.20 U	0.20 UJ
99BW10	14MLW0626N99BW10	N	6/26/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	12.8	0.20 U
99BW10	14MLW0626D99BW10	FD	6/26/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	12.8	0.20 U
99BW10	14MLW1005N99BW10	N	10/5/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	12.6	0.20 U
99BW11	14MLW0627N99BW11	N	6/27/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
99BW11	14MLW1005N99BW11	N	10/5/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
99BW12	14MLW0624N99BW12	N	6/24/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.28	0.20 U
99BW12	14MLW1001N99BW12	N	10/1/2014	0.20 U	0.20 U	0.20 UJ	0.20 U	0.20 U	0.20 U	0.29	0.20 UJ
99BW12	14MLW1005N99BW12	N	10/5/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.38	0.20 U
99BW12	14MLW1005D99BW12	FD	10/5/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.32	0.20 U
99BW14	14MLW0625N99BW14	N	6/25/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
99BW14	14MLW1001N99BW14	N	10/1/2014	0.20 U	0.20 U	0.20 UJ	0.20 U	0.20 U	0.20 U	0.20 U	0.20 UJ
99BW15	14MLW0623N99BW15	N	6/23/2014	0.20 U	0.20 U	0.20 U	0.20 U	1.58	0.20 U	6.75	0.20 U

			Analyte Name	1,1,1-TCA	1,1-DCA	1,1-DCE	1,2-DCA	cis-1,2-DCE	trans-1,2-DCE	TCE	VC
			CAS RN	71-55-6	75-34-3	75-35-4	107-06-2	156-59-2	156-60-5	79-01-6	75-01-4
			MCL	200 µg/l	5 µg/l	7 µg/l	5 µg/l	70 µg/l	100 µg/l	5 µg/l	2 µg/l
Well ID	**Sample Name**	**Sample Type**	**Sample Date**								
99BW15	14MLW1001N99BW15	N	10/1/2014	0.20 U	0.20 U	0.20 UJ	0.20 U	1.62	0.20 U	6.77	0.20 UJ
99BW16	14MLW0623N99BW16	N	6/23/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	1.65	0.20 U
99BW16	14MLW1003N99BW16	N	10/3/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	1.84	0.20 U
99BW18	14MLW0626N99BW18	N	6/26/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	7.19	0.20 U
99BW18	14MLW1005N99BW18	N	10/5/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	8.28	0.20 U
Whole House Filters at Private Wells											
WP-119 (Influent)	14MLW01AWP119	N	11/19/2013	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	3.99	0.20 U
WP-119 (Mid)	14MLW01BWP119	N	11/19/2013	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
WP-119 (Effluent)	14MLW01CWP119	N	11/19/2013	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
WP-119 (Influent)	14MLW02AWP119	N	2/20/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	3.95	0.20 U
WP-119 (Mid)	14MLW02BWP119	N	2/20/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
WP-119 (Effluent)	14MLW02CWP119	N	2/20/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
WP-119 (Influent)	14MLW0624NWP119A	N	6/24/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	4.25	0.20 U
WP-119 (Mid)	14MLW0624NWP119B	N	6/24/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
WP-119 (Effluent)	14MLW0624NWP119C	N	6/24/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
WP-121 (Influent)	14MLW01AWP121	N	11/19/2013	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	4.02	0.20 U
WP-121 (Mid)	14MLW01BWP121	N	11/19/2013	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
WP-121 (Effluent)	14MLW01CWP121	N	11/19/2013	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
WP-121 (Influent)	14MLW02AWP121	N	2/20/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	3.47	0.20 U
WP-121 (Mid)	14MLW02BWP121	N	2/20/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
WP-121 (Effluent)	14MLW02CWP121	N	2/20/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
WP-121 (Effluent)	14MLW22CWP121	FD	2/20/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
WP-121 (Influent)	14MLW0624NWP121A1	N	6/24/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	4.89	0.20 U
WP-121 (Mid)	14MLW0624NWP121B1	N	6/24/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
WP-121 (Effluent)	14MLW0624NWP121C1	N	6/24/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
WP-121 (Influent)	14MLW1002NWP121A1	N	10/2/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	4.67	0.20 U
WP-121 (Mid)	14MLW1002NWP121B1	N	10/2/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
WP-121 (Effluent)	14MLW1002NWP121C1	N	10/2/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
WP-123	14MLW001WP123	N	11/19/2013	0.20 U	0.20 U	0.20 U	0.20 U	0.29	0.20 U	2.81	0.20 U
WP-123	14MLW201WP123	FD	11/19/2013	0.20 U	0.20 U	0.20 U	0.20 U	0.25	0.20 U	2.76	0.20 U
WP-123	14MLW002WP123	N	2/20/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.34	0.20 U	2.28	0.20 U
WP-123	14MLW202WP123	FD	2/20/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.33	0.20 U	2.19	0.20 U

			Analyte Name	1,1,1-TCA	1,1-DCA	1,1-DCE	1,2-DCA	cis-1,2-DCE	trans-1,2-DCE	TCE	VC
			CAS RN	71-55-6	75-34-3	75-35-4	107-06-2	156-59-2	156-60-5	79-01-6	75-01-4
			MCL	200 µg/l	5 µg/l	7 µg/l	5 µg/l	70 µg/l	100 µg/l	5 µg/l	2 µg/l
Well ID	Sample Name	Sample Type	Sample Date								
WP-123	14MLW0623NWP123	N	6/23/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.15 J	0.20 U	3.82	0.20 U
WP-123 (Influent)	14MLW1002NWP123A1	N	10/2/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.18 J	0.20 U	3.71	0.20 UJ
WP-123 (Mid)	14MLW1002NWP123B1	N	10/2/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 UJ
WP-123 (Effluent)	14MLW1002NWP123C1	N	10/2/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 UJ
WP-124 (Influent)	14MLW01AWP124	N	11/19/2013	0.20 U	0.20 U	0.20 U	0.20 U	0.95	0.20 U	4.32	0.20 U
WP-124 (Mid)	14MLW01BWP124	N	11/19/2013	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
WP-124 (Effluent)	14MLW01CWP124	N	11/19/2013	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
WP-124 (Influent)	14MLW02AWP124	N	2/20/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.86	0.20 U	3.72	0.20 U
WP-124 (Mid)	14MLW02BWP124	N	2/20/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
WP-124 (Effluent)	14MLW02CWP124	N	2/20/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
WP-124 (Effluent)	14MLW22CWP124	FD	2/20/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
WP-124	14MLW0623NWP124	N	6/23/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
WP-124 (Influent)	14MLW1002NWP124A1	N	10/2/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.77	0.20 U	3.48	0.20 UJ
WP-124 (Mid)	14MLW1002NWP124B1	N	10/2/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 UJ
WP-124 (Effluent)	14MLW1002NWP124C1	N	10/2/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 UJ
WP-129 (Influent)	14MLW01AWP129	N	11/19/2013	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	2.99	0.20 U
WP-129 (Mid)	14MLW01BWP129	N	11/19/2013	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
WP-129 (Effluent)	14MLW01CWP129	N	11/19/2013	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
WP-129 (Influent)	14MLW02AWP129	N	2/21/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	2.76	0.20 U
WP-129 (Mid)	14MLW02BWP129	N	2/21/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
WP-129 (Effluent)	14MLW02CWP129	N	2/21/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
WP-129 (Influent)	14MLW0625NWP129A1	N	6/25/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	2.11	0.20 U
WP-129 (Mid)	14MLW0625NWP129B1	N	6/25/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
WP-129 (Effluent)	14MLW0625NWP129C1	N	6/25/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
WP-129 (Influent)	14MLW1002NWP129A1	N	10/2/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	1.41	0.20 U
WP-129 (Mid)	14MLW1002NWP129B1	N	10/2/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
WP-129 (Effluent)	14MLW1002NWP129C1	N	10/2/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
WP-129 (Effluent)	14MLW1002DWP129C1	FD	10/2/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
WP-14 (Influent)	14MLW01AWP14	N	11/18/2013	0.20 U	0.20 U	0.20 U	0.20 U	0.87	0.20 U	3.89	0.20 U
WP-14 (Mid)	14MLW01BWP14	N	11/18/2013	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
WP-14 (Effluent)	14MLW01CWP14	N	11/18/2013	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
WP-14 (Influent)	14MLW02AWP14	N	2/19/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.92	0.20 U	3.75	0.20 U

			Analyte Name	1,1,1-TCA	1,1-DCA	1,1-DCE	1,2-DCA	cis-1,2-DCE	trans-1,2-DCE	TCE	VC
			CAS RN	71-55-6	75-34-3	75-35-4	107-06-2	156-59-2	156-60-5	79-01-6	75-01-4
			MCL	200 µg/l	5 µg/l	7 µg/l	5 µg/l	70 µg/l	100 µg/l	5 µg/l	2 µg/l
Well ID	Sample Name	Sample Type	Sample Date								
WP-14 (Mid)	14MLW02BWP14	N	2/19/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
WP-14 (Effluent)	14MLW02CWP14	N	2/19/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
WP-14 (Influent)	14MLW0519NWP14A1	N	5/19/2014	0.20 U	0.20 U	0.20 U	0.20 U	1.06	0.20 U	3.89	0.20 U
WP-14 (Mid)	14MLW0519NWP14B1	N	5/19/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
WP-14 (Effluent)	14MLW0519NWP14C1	N	5/19/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
WP-14 (Effluent)	14MLW0519DWP14C1	FD	5/19/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
WP-14 (Mid)	14MLW0521NWP14B2	N	5/21/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
WP-14 (Effluent)	14MLW0521NWP14C2	N	5/21/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
WP-14 (Effluent)	14MLW0521DWP14C2	FD	5/21/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
WP-14 (Influent)	14MLW1003NWP14A1	N	10/3/2014	0.20 U	0.20 U	0.20 U	0.20 U	1.03	0.20 U	3.81	0.20 U
WP-70 (Influent)	14MLW01AWP70	N	11/19/2013	0.20 U	0.20 U	0.20 U	0.20 U	0.18 J	0.20 U	3.83	0.20 U
WP-70 (Mid)	14MLW01BWP70	N	11/19/2013	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
WP-70 (Effluent)	14MLW01CWP70	N	11/19/2013	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
WP-70 (Influent)	14MLW02AWP70	N	2/20/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20	0.20 U	3.58	0.20 U
WP-70 (Mid)	14MLW02BWP70	N	2/20/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
WP-70 (Effluent)	14MLW02CWP70	N	2/20/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
WP-70 (Influent)	14MLW0519NWP70A1	N	5/19/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.23	0.20 U	2.81	0.20 U
WP-70 (Mid)	14MLW0519NWP70B1	N	5/19/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
WP-70 (Effluent)	14MLW0519NWP70C1	N	5/19/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
WP-70 (Mid)	14MLW0521NWP70B2	N	5/21/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
WP-70 (Effluent)	14MLW0521NWP70C2	N	5/21/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
WP-70 (Influent)	14MLW1002NWP70A2	N	10/2/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.19 J	0.20 U	4.11	0.20 UJ
WP-70 (Influent)	14MLW1002DWP70A2	FD	10/2/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.22	0.20 U	4.35	0.20 UJ
WP-83 (Influent)	14MLW01AWP83	N	11/18/2013	0.20 U	0.20 U	0.20 U	0.20 U	0.29	0.20 U	1.57	0.20 U
WP-83 (Mid)	14MLW01BWP83	N	11/18/2013	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
WP-83 (Effluent)	14MLW01CWP83	N	11/18/2013	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
WP-83 (Effluent)	14MLW21CWP83	FD	11/18/2013	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
WP-83 (Influent)	14MLW02AWP83	N	2/19/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.29	0.20 U	1.34	0.20 U
WP-83 (Mid)	14MLW02BWP83	N	2/19/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
WP-83 (Effluent)	14MLW02CWP83	N	2/19/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
WP-83 (Effluent)	14MLW22CWP83	FD	2/19/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
WP-83 (Influent)	14MLW0519NWP83A1	N	5/19/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.23	0.20 U	1.94	0.20 U

			Analyte Name	1,1,1-TCA	1,1-DCA	1,1-DCE	1,2-DCA	cis-1,2-DCE	trans-1,2-DCE	TCE	VC
			CAS RN	71-55-6	75-34-3	75-35-4	107-06-2	156-59-2	156-60-5	79-01-6	75-01-4
			MCL	200 µg/l	5 µg/l	7 µg/l	5 µg/l	70 µg/l	100 µg/l	5 µg/l	2 µg/l
Well ID	Sample Name	Sample Type	Sample Date								
WP-83 (Mid)	14MLW0519NWP83B1	N	5/19/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.17 J	0.20 U	0.20 U	0.20 U
WP-83 (Effluent)	14MLW0519NWP83C1	N	5/19/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
WP-83 (Mid)	14MLW0521NWP83B2	N	5/21/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
WP-83 (Effluent)	14MLW0521NWP83C2	N	5/21/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
WP-83 (Influent)	14MLW1003NWP83A1	N	10/3/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.30	0.20 U	1.07	0.20 U
WP-86 (Influent)	14MLW01AWP86	N	11/18/2013	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	2.64	0.20 U
WP-86 (Mid)	14MLW01BWP86	N	11/18/2013	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
WP-86 (Effluent)	14MLW01CWP86	N	11/18/2013	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
WP-86 (Influent)	14MLW02AWP86	N	2/19/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	3.17	0.20 U
WP-86 (Mid)	14MLW02BWP86	N	2/19/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
WP-86 (Effluent)	14MLW02CWP86	N	2/19/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
WP-86 (Influent)	14MLW0519NWP86A1	N	5/19/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	1.35	0.20 U
WP-86 (Mid)	14MLW0519NWP86B1	N	5/19/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
WP-86 (Effluent)	14MLW0519NWP86C1	N	5/19/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
WP-86 (Mid)	14MLW0521NWP86B2	N	5/21/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
WP-86 (Effluent)	14MLW0521NWP86C2	N	5/21/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
WP-86 (Influent)	14MLW1003NWP86A1	N	10/3/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	2.02	0.20 U
Private Wells											
WP-03	14MLW0626NWP03	N	6/26/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.24	0.20 U	1.09	0.20 U
WP-03	14MLW0626DWP03	FD	6/26/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.31	0.20 U	1.16	0.20 U
WP-04	14MLW0626NWP04	N	6/26/2014	0.20 U	0.20 U	0.20 U	0.20 U	1.52	0.20 U	4.83	0.20 U
WP-04	14MLW1002NWP04	N	10/2/2014	0.20 U	0.20 U	0.20 U	0.20 U	1.40	0.20 U	4.89	0.20 UJ
WP-04	14MLW1002DWP04	FD	10/2/2014	0.20 U	0.20 U	0.20 U	0.20 U	1.56	0.20 U	4.32	0.20 UJ
WP-09	14MLW0624NWP09	N	6/24/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
WP-10	14MLW0626NWP10	N	6/26/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
WP-105	14MLW0625NWP105	N	6/25/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.35	0.20 U
WP-111	14MLW0625NWP111	N	6/25/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.30	0.20 U
WP-116	14MLW0623NWP116	N	6/23/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.40	0.20 U	1.70	0.20 U
WP-116	14MLW0623DWP116	FD	6/23/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.36	0.20 U	1.53	0.20 U
WP-118	14MLW0623NWP118	N	6/23/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	1.24	0.20 U
WP-120	14MLW0625NWP120	N	6/25/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.42	0.20 U
WP-122	14MLW0625NWP122	N	6/25/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.54	0.20 U

			Analyte Name	1,1,1-TCA	1,1-DCA	1,1-DCE	1,2-DCA	cis-1,2-DCE	trans-1,2-DCE	TCE	VC
			CAS RN	71-55-6	75-34-3	75-35-4	107-06-2	156-59-2	156-60-5	79-01-6	75-01-4
			MCL	200 µg/l	5 µg/l	7 µg/l	5 µg/l	70 µg/l	100 µg/l	5 µg/l	2 µg/l
Well ID	Sample Name	Sample Type	Sample Date								
WP-125	14MLW001WP125	N	11/19/2013	0.20 U	0.20 U	0.20 U	0.20 U	0.72	0.20 U	3.48	0.20 U
WP-125	14MLW002WP125	N	2/20/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.70	0.20 U	3.44	0.20 U
WP-125	14MLW0623NWP125	N	6/23/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.62	0.20 U	3.12	0.20 U
WP-125	14MLW1002NWP125	N	10/2/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.68	0.20 U	3.42	0.20 UJ
WP-126	14MLW0623NWP126	N	6/23/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.23	0.20 U	1.06	0.20 U
WP-127	14MLW0625NWP127	N	6/25/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.72	0.20 U
WP-127	14MLW0625DWP127	FD	6/25/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.70	0.20 U
WP-128	14MLW0625NWP128	N	6/25/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.26	0.20 U
WP-130	14MLW0625NWP130	N	6/25/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.17 J	0.20 U
WP-131	14MLW001WP131	N	11/19/2013	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.88	0.20 U
WP-131	14MLW002WP131	N	2/20/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.80	0.20 U
WP-131	14MLW0625NWP131	N	6/25/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	2.42	0.20 U
WP-131	14MLW1003NWP131	N	10/3/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	1.95	0.20 U
WP-136	14MLW0626NWP136	N	6/26/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	1.38	0.20 U
WP-138	14MLW0626NWP138	N	6/26/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.24	0.20 U
WP-139	14MLW0626NWP139	N	6/26/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.77	0.20 U
WP-13E	14MLW0624NWP13E	N	6/24/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
WP-143	14MLW0626NWP143	N	6/26/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.67	0.20 U
WP-144	14MLW0626NWP144	N	6/26/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.38	0.20 U
WP-145	14MLW0626NWP145	N	6/26/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.34	0.20 U
WP-145	14MLW0626DWP145	FD	6/26/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.35	0.20 U
WP-147	14MLW0625NWP147	N	6/25/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20	0.20 U
WP-148	14MLW0625NWP148	N	6/25/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.16 J	0.20 U
WP-149	14MLW0625NWP149	N	6/25/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
WP-150	14MLW0625NWP150	N	6/25/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
WP-151	14MLW0625NWP151	N	6/25/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.16 J	0.20 U	1.50	0.20 U
WP-152	14MLW0626NWP152	N	6/26/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.21	0.20 U
WP-153	14MLW0626NWP153	N	6/26/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.36	0.20 U
WP-154	14MLW0626NWP154	N	6/26/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.33	0.20 U
WP-155	14MLW0626NWP155	N	6/26/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.26	0.20 U
WP-156	14MLW0623NWP156	N	6/23/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.57	0.20 U
WP-156	14MLW0623DWP156	FD	6/23/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.58	0.20 U

			Analyte Name	1,1,1-TCA	1,1-DCA	1,1-DCE	1,2-DCA	cis-1,2-DCE	trans-1,2-DCE	TCE	VC
			CAS RN	71-55-6	75-34-3	75-35-4	107-06-2	156-59-2	156-60-5	79-01-6	75-01-4
			MCL	200 µg/l	5 µg/l	7 µg/l	5 µg/l	70 µg/l	100 µg/l	5 µg/l	2 µg/l
Well ID	Sample Name	Sample Type	Sample Date								
WP-164	14MLW0624NWP164	N	6/24/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.33	0.20 U
WP-165	14MLW0626NWP165	N	6/26/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
WP-167	14MLW001WP167	N	11/19/2013	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	2.29	0.20 U
WP-167	14MLW002WP167	N	2/21/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	1.22	0.20 U
WP-167	14MLW0624NWP167	N	6/24/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	2.53	0.20 U
WP-167	14MLW1003NWP167	N	10/3/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	2.30	0.20 U
WP-168	14MLW001WP168	N	11/19/2013	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	3.32	0.20 U
WP-168	14MLW002WP168	N	2/21/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	2.12	0.20 U
WP-168	14MLW0624NWP168	N	6/24/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	2.32	0.20 U
WP-168	14MLW1003NWP168	N	10/3/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	2.78	0.20 U
WP-169	14MLW0624NWP169	N	6/24/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	1.95	0.20 U
WP-172	14MLW0625NWP172	N	6/25/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.59	0.20 U
WP-175	14MLW0624NWP175	N	6/24/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.38	0.20 U
WP-177	14MLW0624NWP177	N	6/24/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
WP-178	14MLW0623NWP178	N	6/23/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.27	0.20 U
WP-179	14MLW0625NWP179	N	6/25/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
WP-179	14MLW0625DWP179	FD	6/25/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
WP-180	14MLW0626NWP180	N	6/26/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
WP-18N	14MLW0624NWP18N	N	6/24/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.27	0.20 U
WP-18S	14MLW0624NWP18S	N	6/24/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20	0.20 U
WP-25W	14MLW0623NWP25W	N	6/23/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.86	0.20 U
WP-27	14MLW001WP27	N	11/18/2013	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
WP-27	14MLW002WP27	N	2/19/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	1.22	0.20 U
WP-27	14MLW0623NWP27	N	6/23/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	1.39	0.20 U
WP-27	14MLW1002NWP27	N	10/2/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	1.33	0.20 UJ
WP-28	14MLW0623NWP28	N	6/23/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	1.19	0.20 U
WP-28	14MLW0623DWP28	FD	6/23/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	1.13	0.20 U
WP-33	14MLW0625NWP33	N	6/25/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.79	0.20 U
WP-45	14MLW0624NWP45	N	6/24/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.92	0.20 U
WP-50	14MLW0623NWP50	N	6/23/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
WP-52	14MLW0624NWP52	N	6/24/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.28	0.20 U
WP-54	14MLW0624NWP54	N	6/24/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U

			Analyte Name	1,1,1-TCA	1,1-DCA	1,1-DCE	1,2-DCA	cis-1,2-DCE	trans-1,2-DCE	TCE	VC
			CAS RN	71-55-6	75-34-3	75-35-4	107-06-2	156-59-2	156-60-5	79-01-6	75-01-4
			MCL	200 µg/l	5 µg/l	7 µg/l	5 µg/l	70 µg/l	100 µg/l	5 µg/l	2 µg/l
Well ID	**Sample Name**	**Sample Type**	**Sample Date**								
WP-57	14MLW0626NWP57	N	6/26/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.55	0.20 U
WP-65	14MLW0625NWP65	N	6/25/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.43	0.20 U
WP-66	14MLW0623NWP66	N	6/23/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.30	0.20 U	1.31	0.20 U
WP-68	14MLW0626NWP68	N	6/26/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.43	0.20 U
WP-69	14MLW0626NWP69	N	6/26/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	1.33	0.20 U
WP-69	14MLW0626DWP69	FD	6/26/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	1.47	0.20 U
WP-71A	14MLW0626NWP71A	N	6/26/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.17 J	0.20 U
WP-71B	14MLW0624NWP71B	N	6/24/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.44	0.20 U
WP-74	14MLW0624NWP74	N	6/24/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	1.23	0.20 U
WP-82	14MLW0623NWP82	N	6/23/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
QC Samples											
	14MLW0619PE01	N	6/19/2014	7.58	0.20 U	5.72	12.9	4.50	16.4	7.87	11.0
	14MLW1118TB01	TB	11/18/2013	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
	14MLW1118TB02	TB	11/18/2013	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
	14MLW1119TB03	TB	11/19/2013	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
	14MLW1119TB04	TB	11/19/2013	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
	14MLW0219TB01	TB	2/19/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
	14MLW0220TB02	TB	2/20/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
	14MLW0221TB03	TB	2/21/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
	14MLW0519TB01	TB	5/19/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
	14MLW0521TB02	TB	5/21/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
	14MLW0521PDTB01	TB	5/21/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
	14MLW0521PDTB02	TB	5/21/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
	14MLW0622TB09	TB	6/22/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
	14MLW0623TB05	TB	6/23/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
	14MLW0624TB10	TB	6/24/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
	14MLW0624TB01	TB	6/24/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
	14MLW0624TB06	TB	6/24/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
	14MLW0625TB11	TB	6/25/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
	14MLW0625TB02	TB	6/25/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
	14MLW0626TB13	TB	6/26/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
	14MLW0626TB12	TB	6/26/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U

			Analyte Name	1,1,1-TCA	1,1-DCA	1,1-DCE	1,2-DCA	cis-1,2-DCE	trans-1,2-DCE	TCE	VC
			CAS RN	71-55-6	75-34-3	75-35-4	107-06-2	156-59-2	156-60-5	79-01-6	75-01-4
			MCL	200 µg/l	5 µg/l	7 µg/l	5 µg/l	70 µg/l	100 µg/l	5 µg/l	2 µg/l
Well ID	**Sample Name**	**Sample Type**	**Sample Date**								
	14MLW0626TB03	TB	6/26/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
	14MLW0626TB07	TB	6/26/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
	14MLW0626TB08	TB	6/26/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
	14MLW0627TB14	TB	6/27/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
	14MLW067TB04	TB	6/27/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
	14MLW0928TB01	TB	9/28/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
	14MLW0929PDTB01	TB	9/29/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
	14MLW0929PDTB02	TB	9/29/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
	14MLW0929TB03	TB	9/29/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
	14MLW0929TB02	TB	9/29/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
	14MLW1001TB05	TB	10/1/2014	0.20 U	0.20 U	0.20 UJ	0.20 U	0.20 U	0.20 U	0.20 U	0.20 UJ
	14MLW1002TB06	TB	10/2/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 UJ
	14MLW1003TB07	TB	10/3/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
	14MLW1004TB08	TB	10/4/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
	14MLW1005TB09	TB	10/5/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
WP-125	14MLW1002EBWP125	EB	10/2/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 UJ
WP-125	14MLW302WP125	EB	2/20/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
	14MLW000FW01	FB	11/19/2013	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
WP-70	14MLW0519FBMW70	FB	5/19/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
WP-13E	14MLW0624FBMW13E	FB	6/24/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
WP-177	14MLW0624FBMW177	FB	6/24/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
WP-70	14MLW1002FBMW70	FB	10/2/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 UJ
04CW03	14MLW0929FB0104CW03	FB	9/29/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
WP-70	14MLW402CWP70	FB	2/20/2014	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U

Sample Type:

N -Normal Sample
EB – Equipment blank
TB – Trip Blank
FB – Field Blank
FD – Field Duplicate
J -Estimated

U – Undetected at the stated limit
UJ – Analyzed for but not detected

APPENDIX C – 2014 Whole House Filter Efficiency Memorandum

U.S. ARMY CORPS of ENGINEERS
Seattle District

Environmental Engineering and Technology Section,
Technical Services Branch, Engineering Division

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Seattle, WA 98134
Tel: 206-764-6792 Fax: 206-764-3706

MEMORANDUM

DATE: August 14, 2014 (revised September 23, 2014)

FROM: Rebecca Weiss – Technical Project Lead, USACE Seattle District

TO: Rod Lobos - Moses Lake RPM, Region 10

SUBJECT: Moses Lake Whole House Filter Efficiency Evaluation

The purpose of this memorandum (memo) is to evaluate results for Siemens AWC-1230 Whole House Filter (WHF) systems installed in May 2013 at Moses Lake residential wells WP-14, WP-70, WP-86, and WP-83. This memo evaluates whether the filters worked sufficiently for a year to protect residents from exposure to trichloroethylene **(**TCE) greater than the Maximum Contaminant Level (MCL). In addition, this memo evaluates whether there is sufficient evidence to support the reduction in filter sampling frequency from quarterly sampling.

More information on the WHF systems can be found within the Work Plan Appendix A – Granular Activated Carbon Filter Installation, Replacement and Maintenance Plan (GAC Plan 2014). Currently, WHFs are installed at private wells that exceed 3.5 ug/L TCE. As summarized in the GAC Plan, WHFs will be replaced annually to compensate for performance reduction due to dissolved solids, iron, biofilm, and adsorption of other organic constituents. Annual change-out will also protect against buildup of nitrates in the system, which can be transformed to toxic nitrites under certain conditions. The validity of conclusions stated in this report are limited to the observed flow and contaminant concentration ranges discussed herein and the assumption that WHFs will be replaced annually.

Flow rates were calculated using flow meter readings recorded at the time of quarterly sampling (August 2013, November, 2013, February 2014, and May 2014) and are presented in **Table 1**. The annual average flow rates ranged from 242 to 2,196 gallons per day. Detected concentrations of TCE and cis-1,2-dichloroethene (CIS) collected at the lead sample port (influent) are summarized in Table 1. **Table 2** summarizes the cumulative flow per filter over the year and the total contaminant mass loading of TCE and CIS to the filters based on influent concentrations.

Overall, the WHFs are working sufficiently to ensure protection of human health. For example, WP-14 experienced moderate to high average flow rates and the highest TCE and CIS concentrations at the lead (influent) sample port. Under these conditions, the WHF was successful in reducing TCE and CIS to undetected concentrations throughout four quarters of evaluation. WP-83 experienced the highest flow rate and had moderately high TCE and CIS influent concentrations. CIS and TCE mass loading over the year for WP-83 was not as great as for WP-14, although WP-83 did have a detection of CIS from the lag (effluent) sample port during the fourth quarter of testing. This evidence suggests that the high average flow rate observed at WP-83 reduced the efficiency of the WHF, but not enough to cause a health concern because the MCLs for TCE and CIS were not exceeded. The fourth quarter CIS effluent concentration at WP-83 was 0.17 ug/L (the CIS MCL is 70 ug/L). The majority of flow experienced at the two residences with higher flow rates (WP-14 and WP-83) occurred between May and August 2013, which correlates with the summer season and assumed use primarily for yard and crop irrigation.

Annual WHF replacement for WP-14, WP-70, WP-86, and WP-83 occurred in May 2014, as summarized in the Work Plan. Four additional residential wells that have WHFs (WP-119 and WP-121, WP-124 and WP-129) will be replaced by November 2014, subject to the availability of funds. Additional conclusions on the efficiency of the remaining WHF system wells will be made after the November 2014 sampling is completed.

The technical team recommends continuing to sample the WHF influent ports quarterly for WHFs WP-14, WP-70, WP-86 and WP-83 to evaluate seasonal trends. However, the sampling frequency for the mid and effluent ports can be reduced to annual sampling based on the findings in this memo.

Results presented in this memo suggest that quarterly sampling of influent ports and annual sampling of mid and effluent ports for WHFs WP-14, WP-70, WP-86 and WP-83 will be sufficient to ensure protection of human health based on the current flow rates, TCE concentrations, and assumption of annual replacement of WHFs.

Table 1. Moses Lake WHF System Flow Meter Readings and Detected Analytes

Well ID	Date	Event [a, b]	Flow Meter Reading (gal)	Quarterly Flow Rate (gal/day)	Lead Influent		Mid/Effluent Detect?
					TCE ug/L	CIS ug/L	
WP-14	8/26/2013	end of Q1	274,230	2,344	4.69	1.14	N
	11/18/2013	end of Q2	349,070	891	3.89	0.87	N
	2/19/2014	end of Q3	395,520	499	3.75	0.92	N
	5/19/2014	end of Q4	481,970	971	3.89	1.06	N
			avg flow	*1,176*	gal/day		
				481,970	gal/yr		
WP-70	8/26/2013	end of Q1	21,690	185	4.12	0.12	N
	11/18/2013	end of Q2	41,635	237	3.83	0.18	N
	2/19/2014	end of Q3	72,191	329	3.58	0.2	N
	5/19/2014	end of Q4	91,578	218	2.81	0.23	N
			avg flow	*242*	gal/day		
				91,578	gal/yr		
WP-86	8/26/2013	end of Q1	117,220	1,002	1.69	<0.20	N
	11/18/2013	end of Q2	153,317	430	2.64	<0.20	N
	2/19/2014	end of Q3	173,570	218	3.17	<0.20	N
	5/19/2014	end of Q4	205,811	362	1.35	<0.20	N
			avg flow	*503*	gal/day		
				205,811	gal/yr		
WP-83	8/26/2013	end of Q1	549,840	4,699	2.08	0.28	N
	11/18/2013	end of Q2	704,419	1,840	1.57	0.29	N
	2/19/2014	end of Q3	755,670	551	1.34	0.29	N
	5/19/2014	end of Q4	906,258	1,692	1.94	0.23	YES
			avg flow	*2,196*	gal/day		
				906,258	gal/yr		

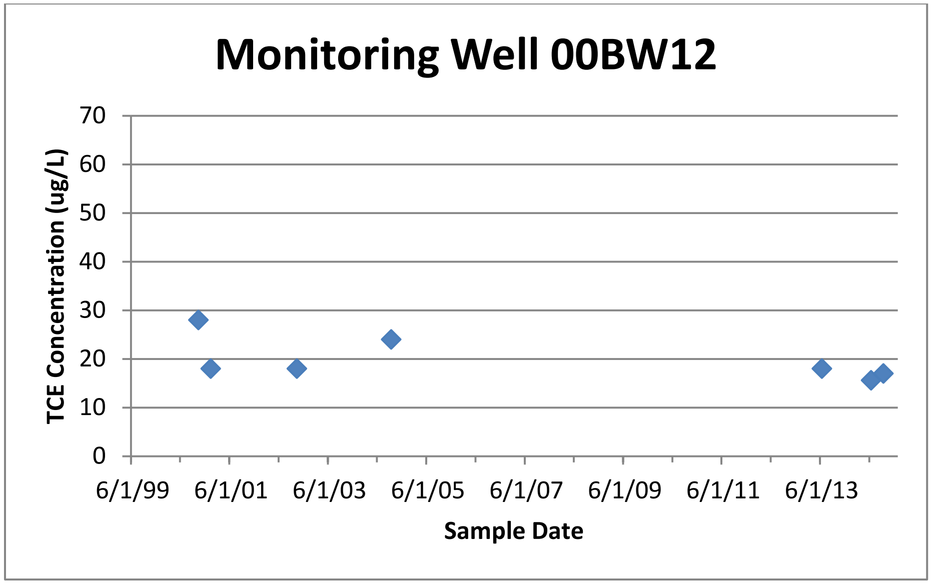
a - Systems were installed in May 2013, which = time 0.

b – Q1 was August 2013, Q2 was November 2013, Q3 was February 2014, Q4 was May 2014

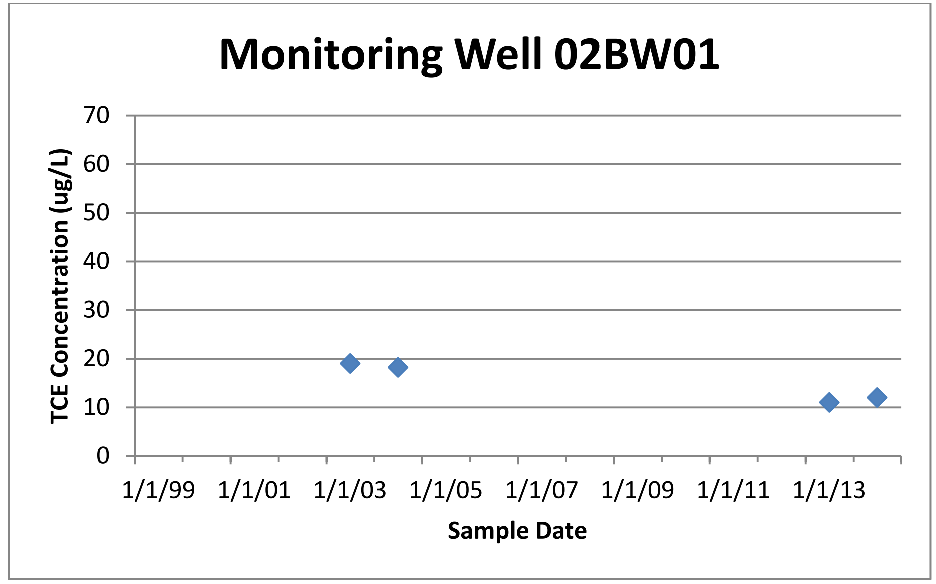
Table 2. Moses Lake WHF System Mass Loading Summary

Well ID	Timeframe	Cumulative Total Flow (gal)	Cumulative TCE Mass (grams)	Cumulative CIS Mass (grams)	Mid/Effluent Detect?
WP-14	Install through Q1	274,230	4.87	1.18	N
	Install through Q2	349,070	5.97	1.43	N
	Install through Q3	395,520	6.63	1.59	N
	Install through Q4	**481,970**	**7.90**	**1.94**	**N**
WP-70	Install through Q1	21,690	0.34	0.01	N
	Install through Q2	41,635	0.63	0.02	N
	Install through Q3	72,191	1.04	0.05	N
	Install through Q4	**91,578**	**1.25**	**0.06**	**N**
WP-86	Install through Q1	117,220	0.75	0.00	N
	Install through Q2	153,317	1.11	0.00	N
	Install through Q3	173,570	1.35	0.00	N
	Install through Q4	**205,811**	**1.52**	**0.00**	**N**
WP-83	Install through Q1	549,840	4.33	0.58	N
	Install through Q2	704,419	5.25	0.75	N
	Install through Q3	755,670	5.51	0.81	N
	Install through Q4	**906,258**	**6.61**	**0.94**	**YES**

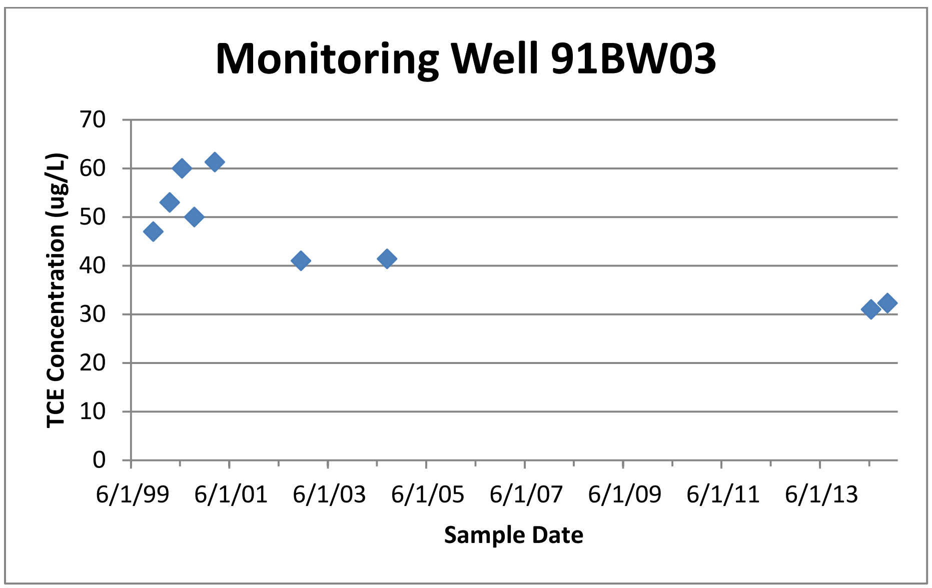
APPENDIX D – TCE Time-Series Graphs



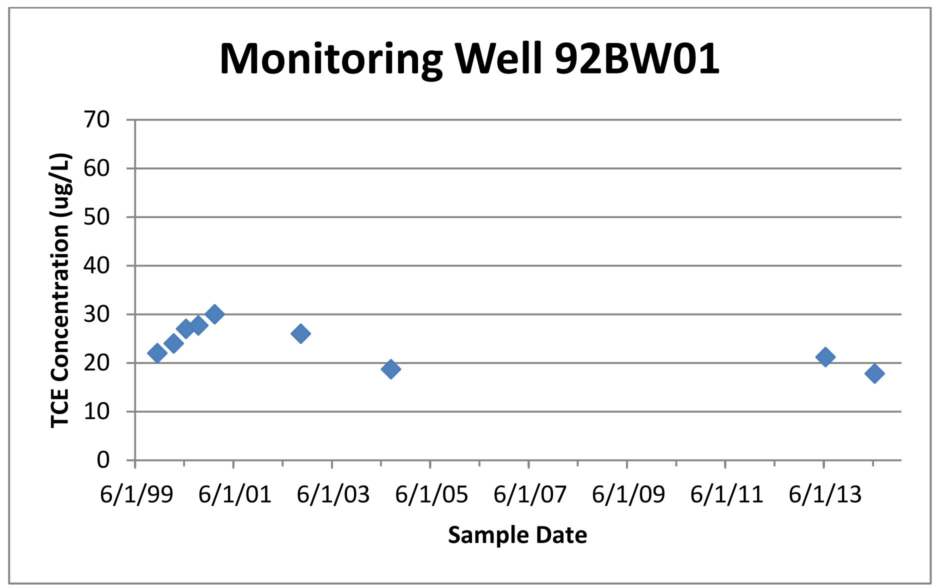
Monitoring Well 00BW12
TCE Concentration (ug/L)
70
60
50
40
30
20
10
0
6/1/99
6/1/01
6/1/03
6/1/05
6/1/07
6/1/09
6/1/11
6/1/13
Sample Date



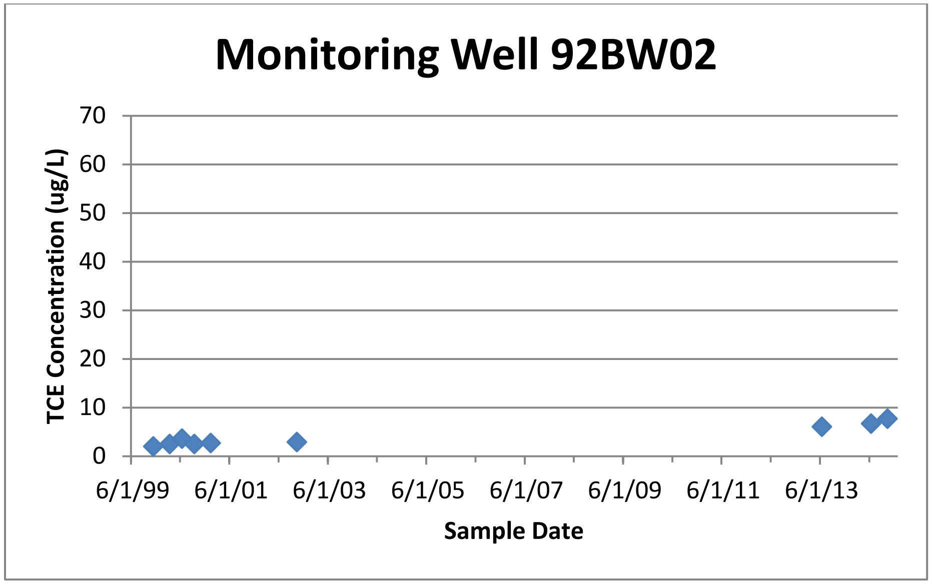
Monitoring Well 02BW01
TCE Concentration (ug/L)
70
60
50
40
30
20
10
0
1/1/99
1/1/01
1/1/03
1/1/05
1/1/07
1/1/09
1/1/11
1/1/13
Sample Date



Monitoring Well 91BW03
TCE Concentration (ug/L)
70
60
50
40
30
20
10
0
6/1/99
6/1/01
6/1/03
6/1/05
6/1/07
6/1/09
6/1/11
6/1/13
Sample Date



Monitoring Well 92BW01
TCE Concentration (ug/L)
70
60
50
40
30
20
10
0
6/1/99
6/1/01
6/1/03
6/1/05
6/1/07
6/1/09
6/1/11
6/1/13
Sample Date


Monitoring Well 92BW02
TCE Concentration (ug/L)
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60
50
40
30
20
10
0
6/1/99
6/1/01
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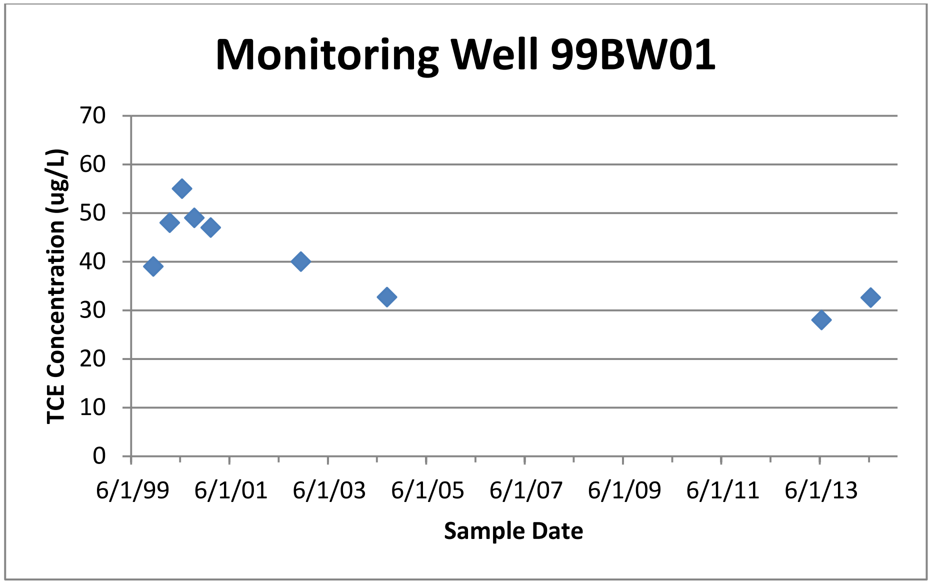
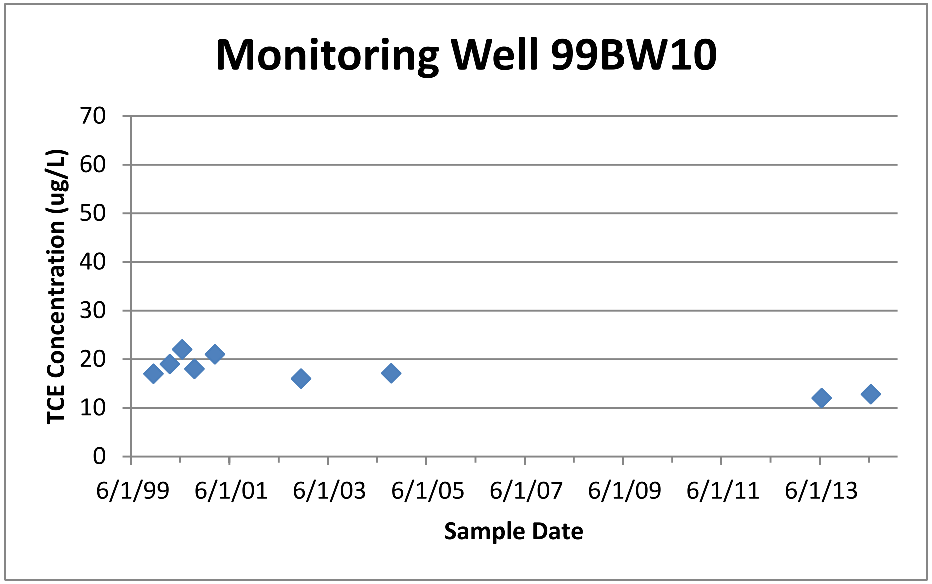
6/1/05
6/1/07
6/1/09
6/1/11
6/1/13
Sample Date


Monitoring Well 99BW01
TCE Concentration (ug/L)
70
60
50
40
30
20
10
0
6/1/99
6/1/01
6/1/03
6/1/05
6/1/07
6/1/09
6/1/11
6/1/13
Sample Date


Monitoring Well 99BW10
TCE Concentration (ug/L)
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60
50
40
30
20
10
0
6/1/99
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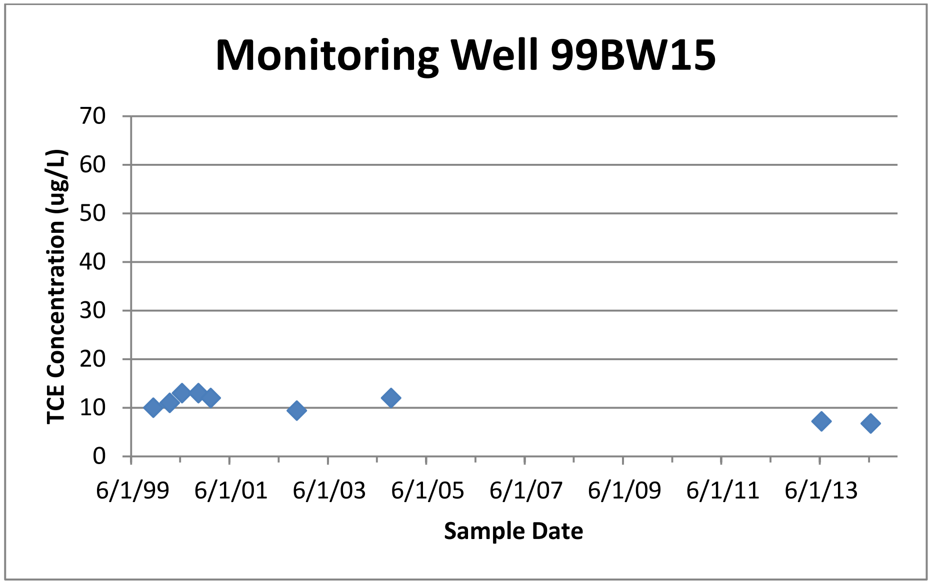
6/1/03
6/1/05
6/1/07
6/1/09
6/1/11
6/1/13
Sample Date


Monitoring Well 99BW15
TCE Concentration (ug/L)
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60
50
40
30
20
10
0
6/1/99
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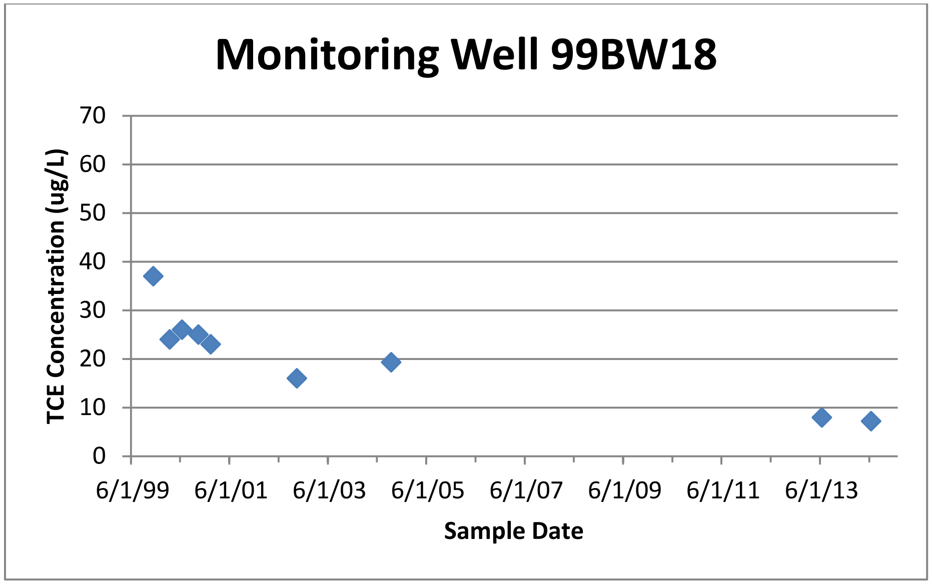
6/1/03
6/1/05
6/1/07
6/1/09
6/1/11
6/1/13
Sample Date


Monitoring Well 99BW18
TCE Concentration (ug/L)
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60
50
40
30
20
10
0
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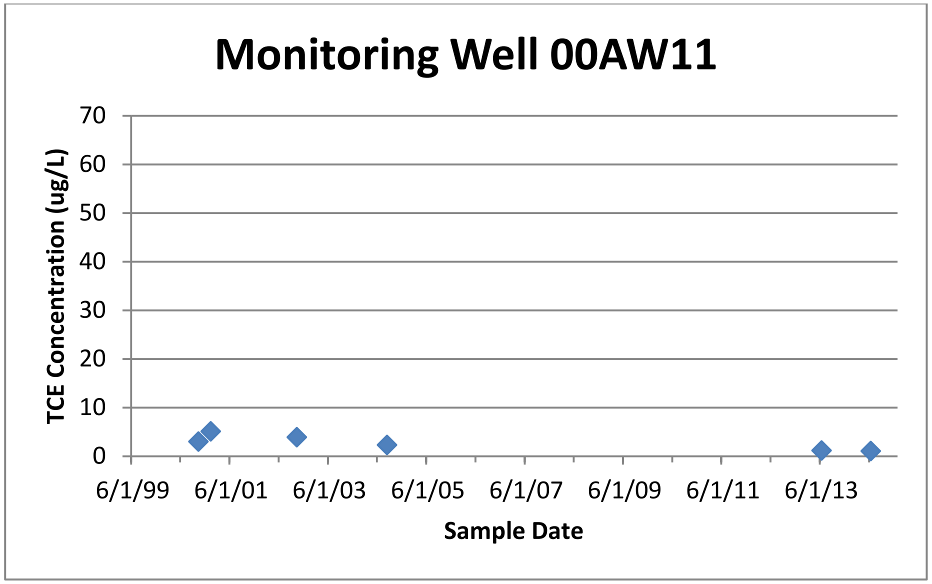
6/1/05
6/1/07
6/1/09
6/1/11
6/1/13
Sample Date


Monitoring Well 00AW11
TCE Concentration (ug/L)
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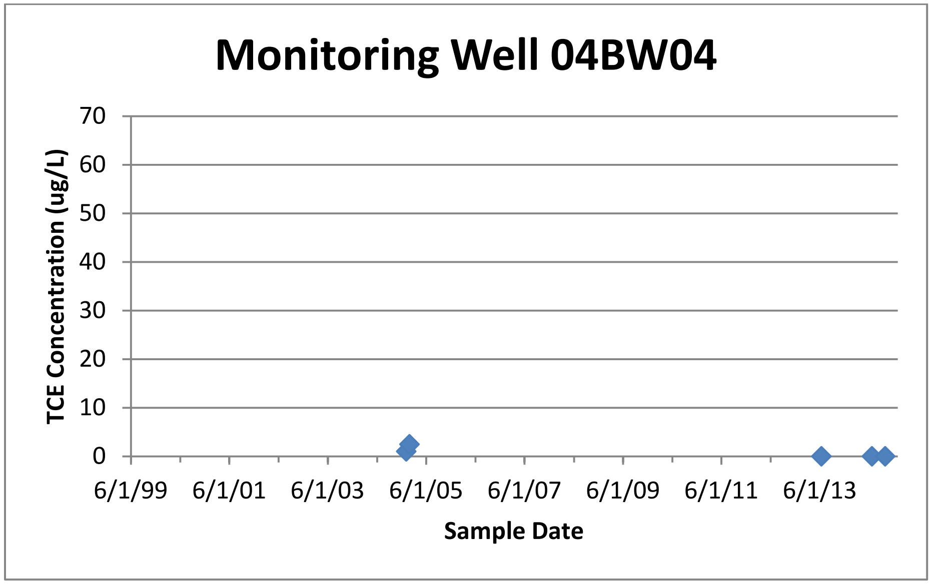
60
50
40
30
20
10
0
6/1/99
6/1/01
6/1/03
6/1/05
6/1/07
6/1/09
6/1/11
6/1/13
Sample Date


Monitoring Well 04BW04
TCE Concentration (ug/L)
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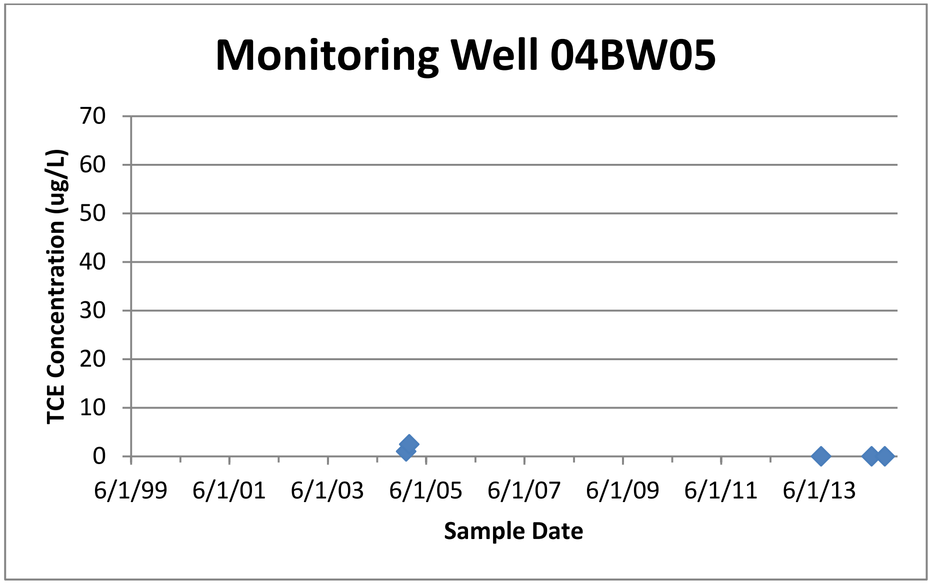
60
50
40
30
20
10
0
6/1/99
6/1/01
6/1/03
6/1/05
6/1/07
6/1/09
6/1/11
6/1/13
Sample Date


Monitoring Well 04BW05
TCE Concentration (ug/L)
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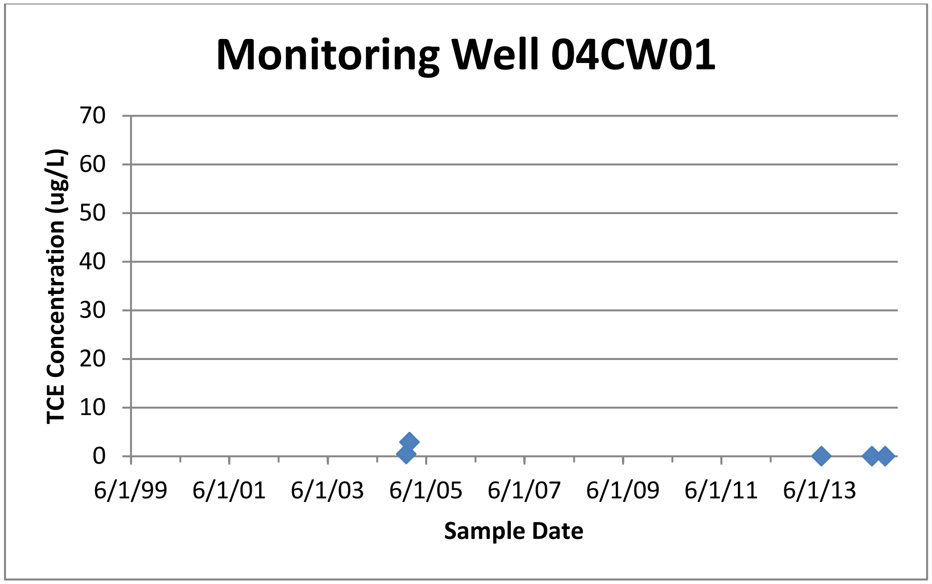
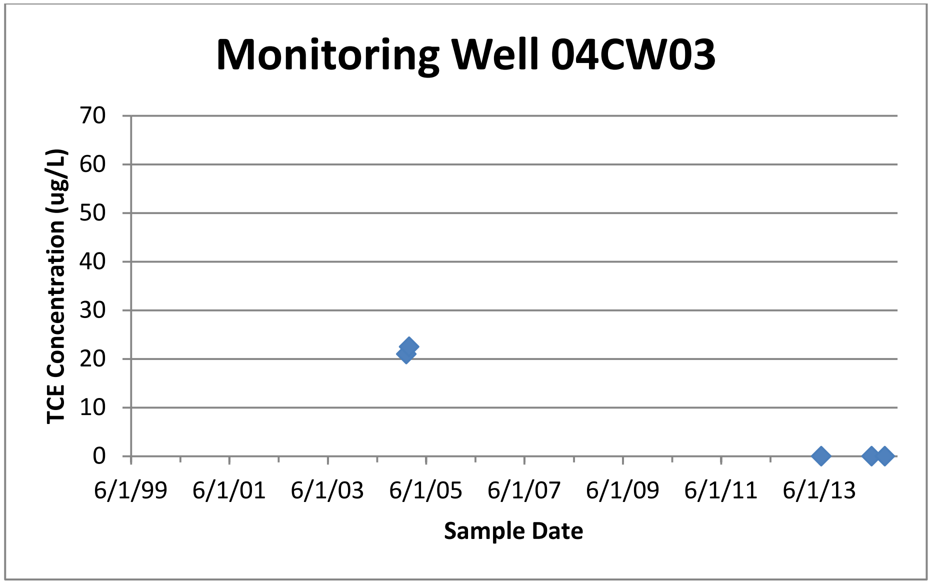
50
40
30
20
10
0
6/1/99
6/1/01
6/1/03
6/1/05
6/1/07
6/1/09
6/1/11
6/1/13
Sample Date


Monitoring Well 04CW01
70
60
50
40
30
20
10
0
TCE Concentration (ug/L)
6/1/99
6/1/01
6/1/03
6/1/05
6/1/07
6/1/09
6/1/11
6/1/13
Sample Date


Monitoring Well 04CW03
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50
40
30
20
10
0
TCE Concentration (ug/L)
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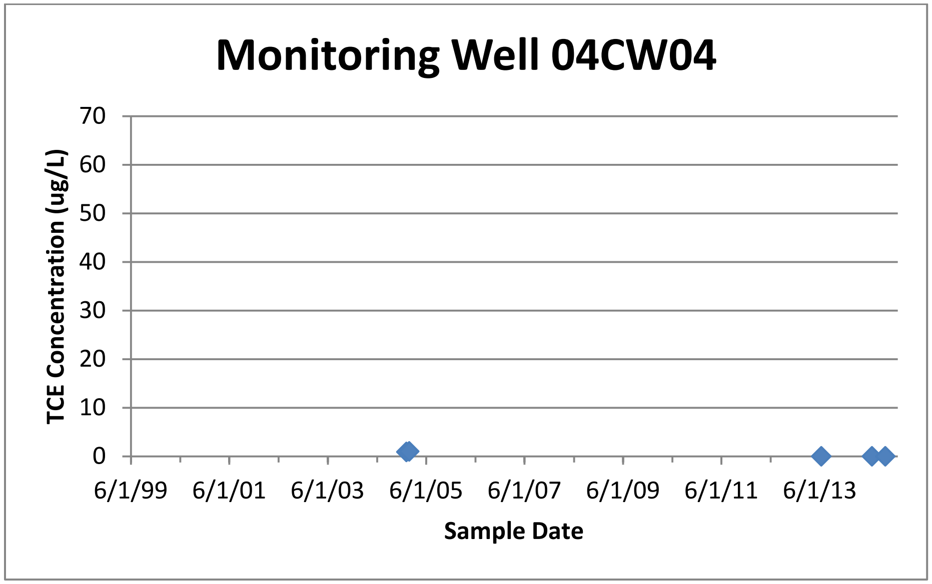
6/1/01
6/1/03
6/1/05
6/1/07
6/1/09
6/1/11
6/1/13
Sample Date


Monitoring Well 04CW04
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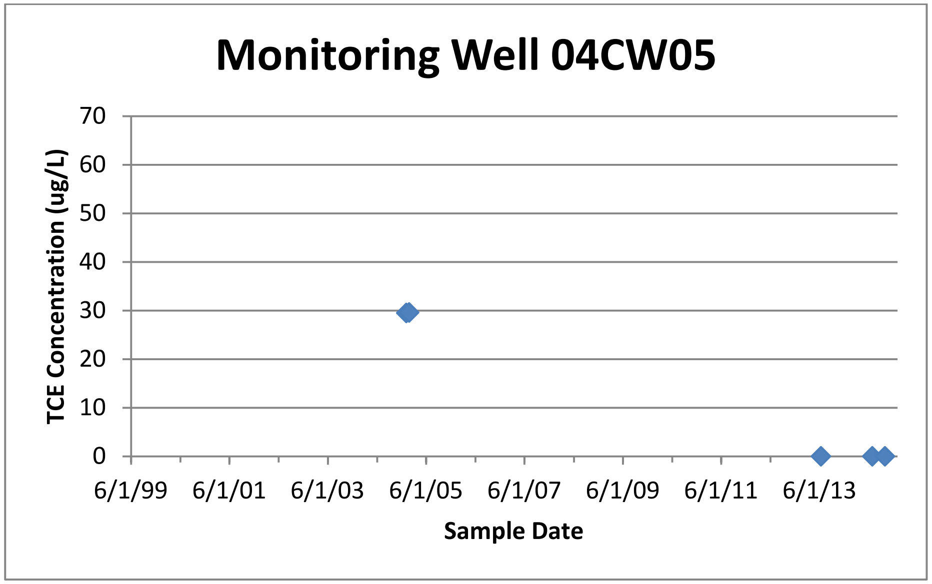
60
50
40
30
20
10
0
TCE Concentration (ug/L)
6/1/99
6/1/01
6/1/03
6/1/05
6/1/07
6/1/09
6/1/11
6/1/13
Sample Date


Monitoring Well 04CW05
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60
50
40
30
20
10
0
TCE Concentration (ug/L)
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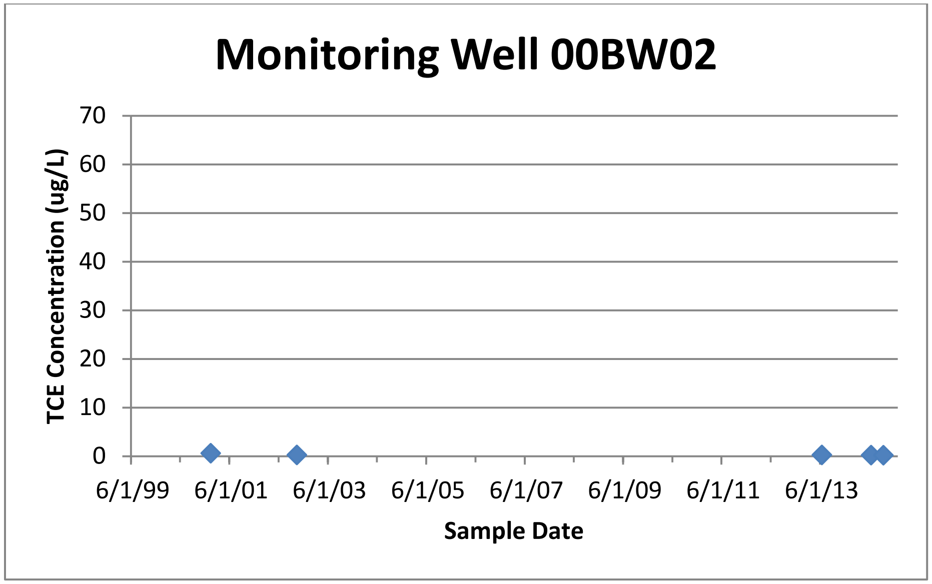
6/1/01
6/1/03
6/1/05
6/1/07
6/1/09
6/1/11
6/1/13
Sample Date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TCE Concentration (ug/L)
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40
30
20
10
0
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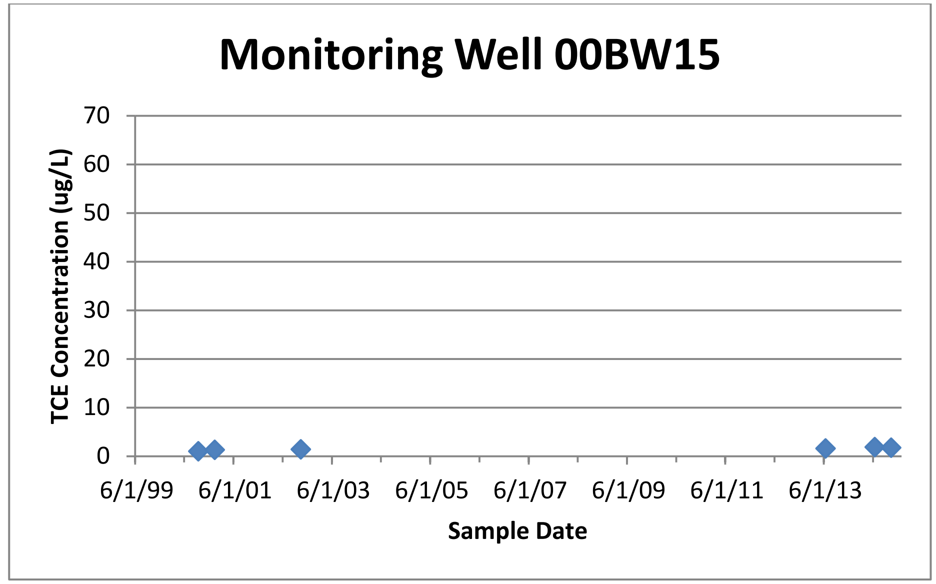
6/1/03
6/1/05
6/1/07
6/1/09
6/1/11
6/1/13
Sample Date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TCE Concentration (ug/L)
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50
40
30
20
10
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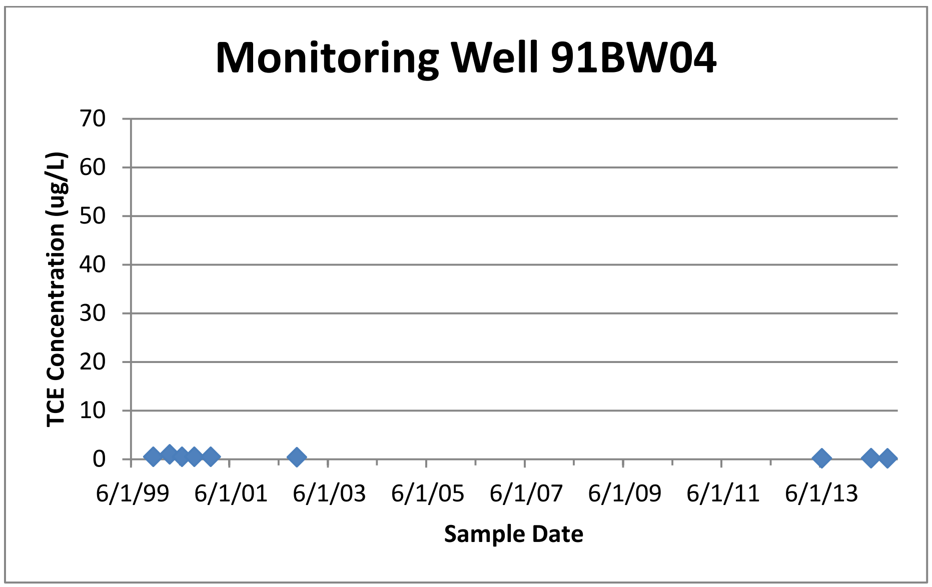
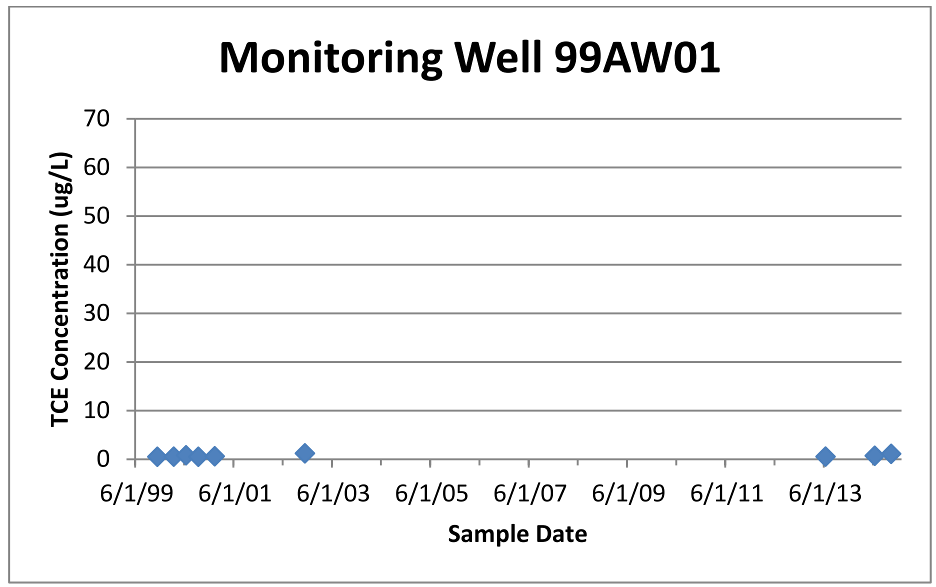
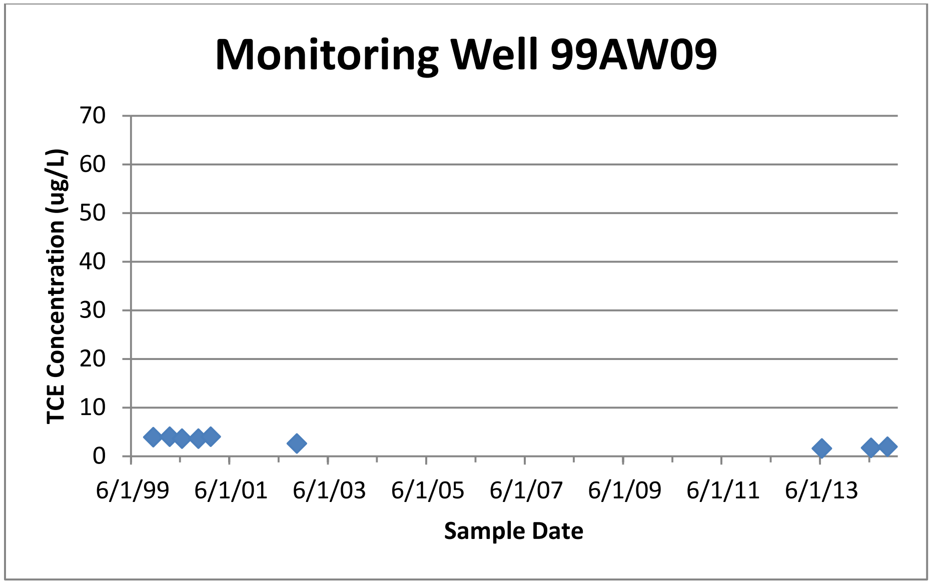
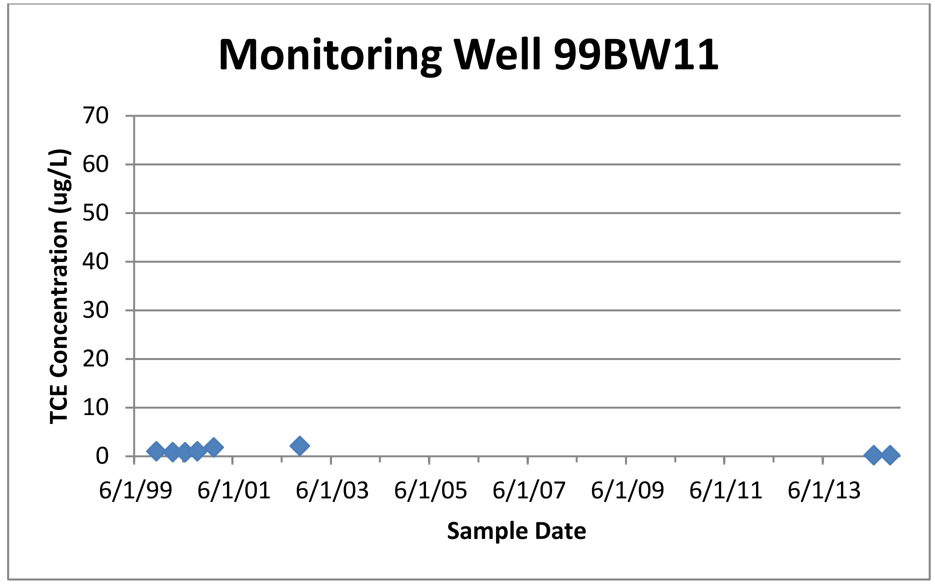
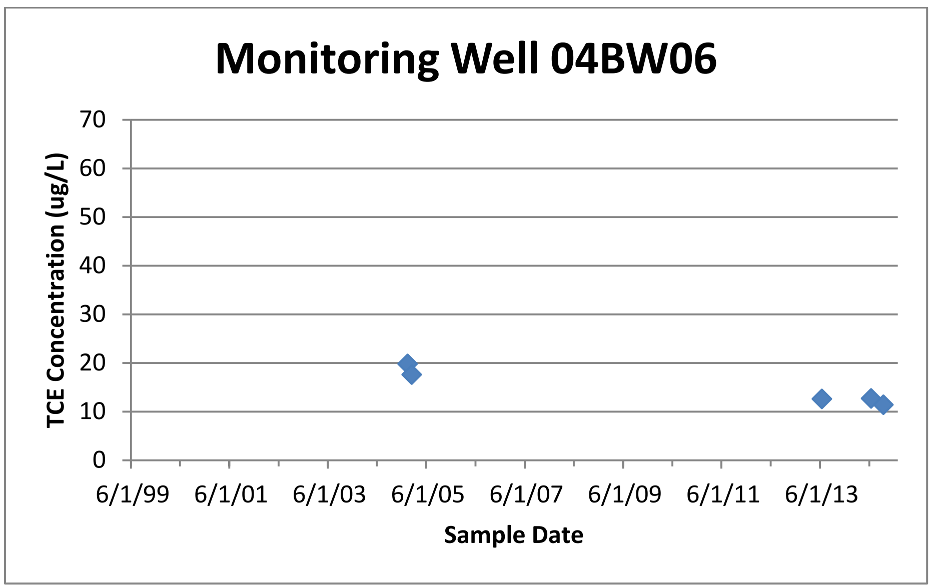
6/1/11
6/1/13
Sample Date

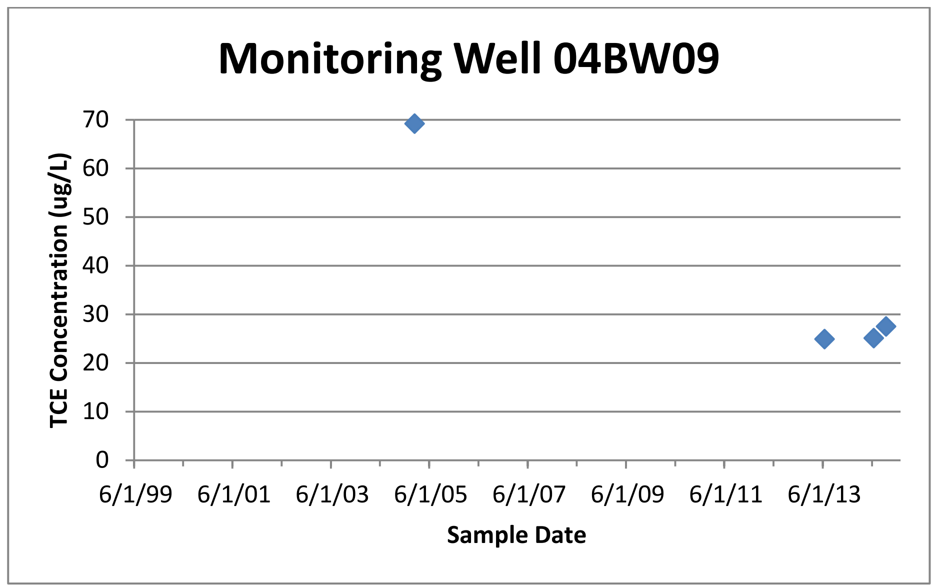

Monitoring Well 91BW04
TCE Concentration (ug/L)
70
60
50
40
30
20
10
0
6/1/99
6/1/01
6/1/03
6/1/05
6/1/07
6/1/09
6/1/11
6/1/13
Sample Date

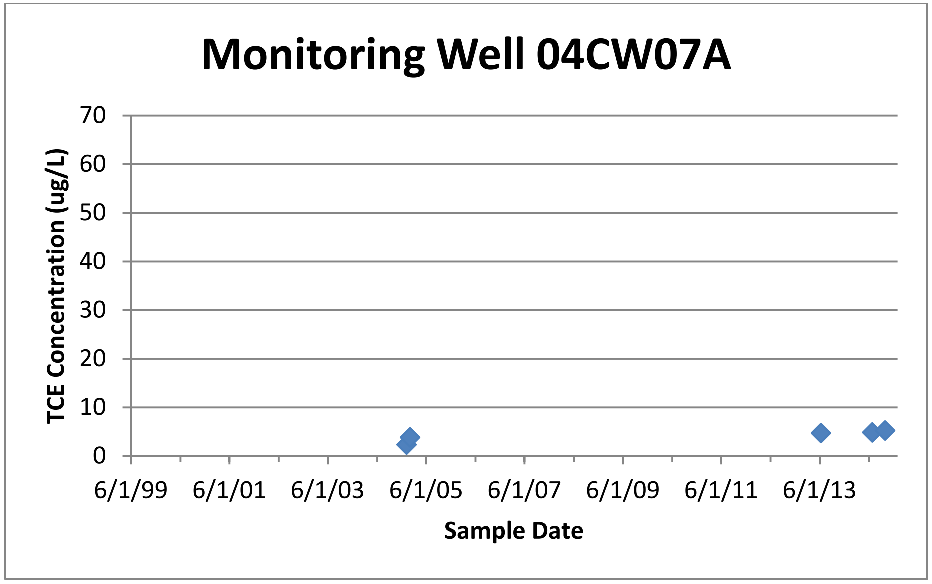

Monitoring Well 99AW01
TCE Concentration (ug/L)
70
60
50
40
30
20
10
0
6/1/99
6/1/01
6/1/03
6/1/05
6/1/07
6/1/09
6/1/11
6/1/13
Sample Date

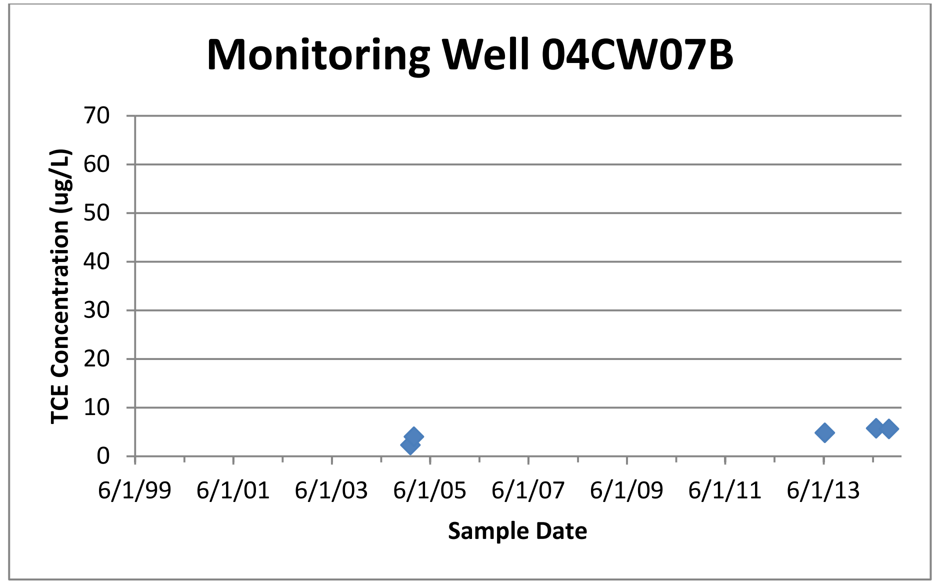

Monitoring Well 99AW09
TCE Concentration (ug/L)
70
60
50
40
30
20
10
0
6/1/99
6/1/01
6/1/03
6/1/05
6/1/07
6/1/09
6/1/11
6/1/13
Sample Date

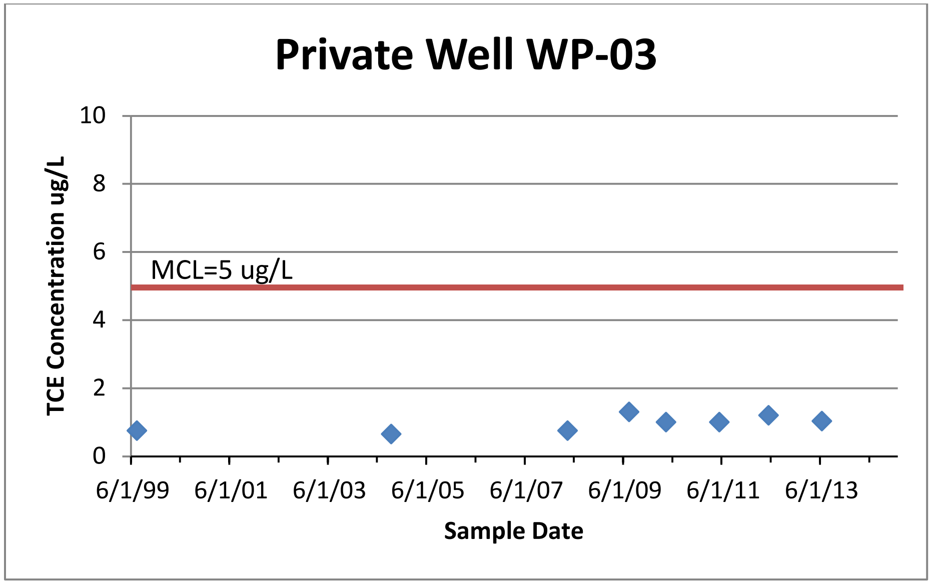

Monitoring Well 99BW11
TCE Concentration (ug/L)
70
60
50
40
30
20
10
0
6/1/99
6/1/01
6/1/03
6/1/05
6/1/07
6/1/09
6/1/11
6/1/13
Sample Date

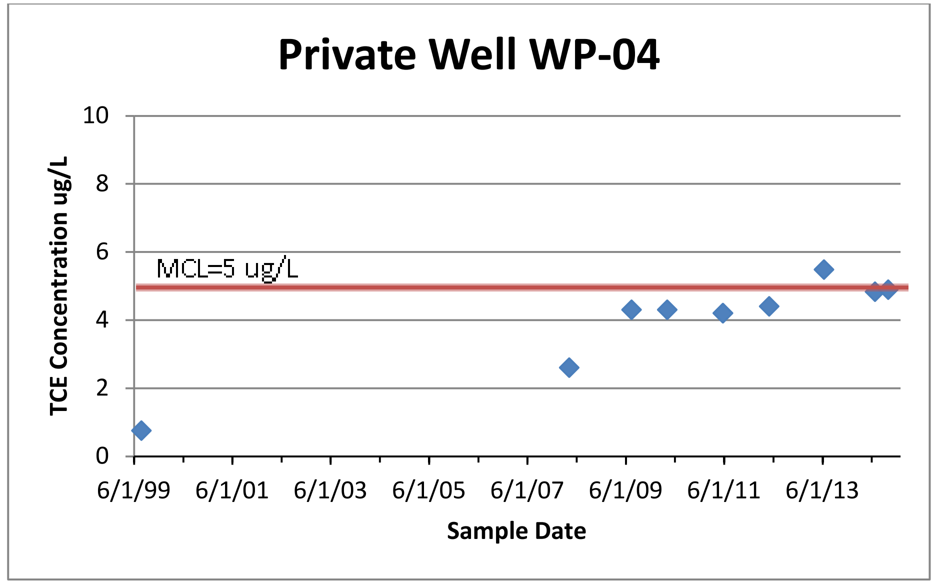

Monitoring Well 04BW06
TCE Concentration (ug/L)
70
60
50
40
30
20
10
0
6/1/99
6/1/01
6/1/03
6/1/05
6/1/07
6/1/09
6/1/11
6/1/13
Sample Date

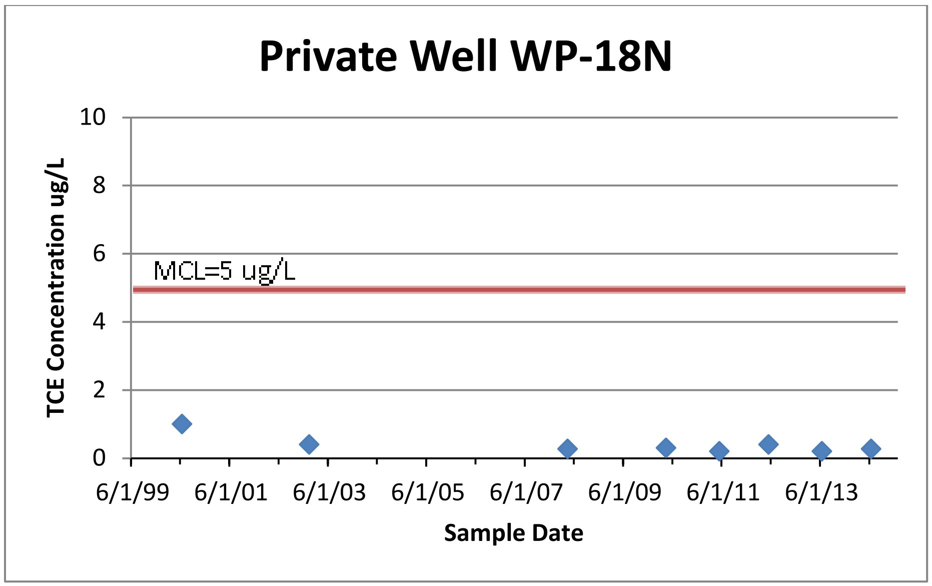

Monitoring Well 04BW09
TCE Concentration (ug/L)
70
60
50
40
30
20
10
0
6/1/99
6/1/01
6/1/03
6/1/05
6/1/07
6/1/09
6/1/11
6/1/13
Sample Date

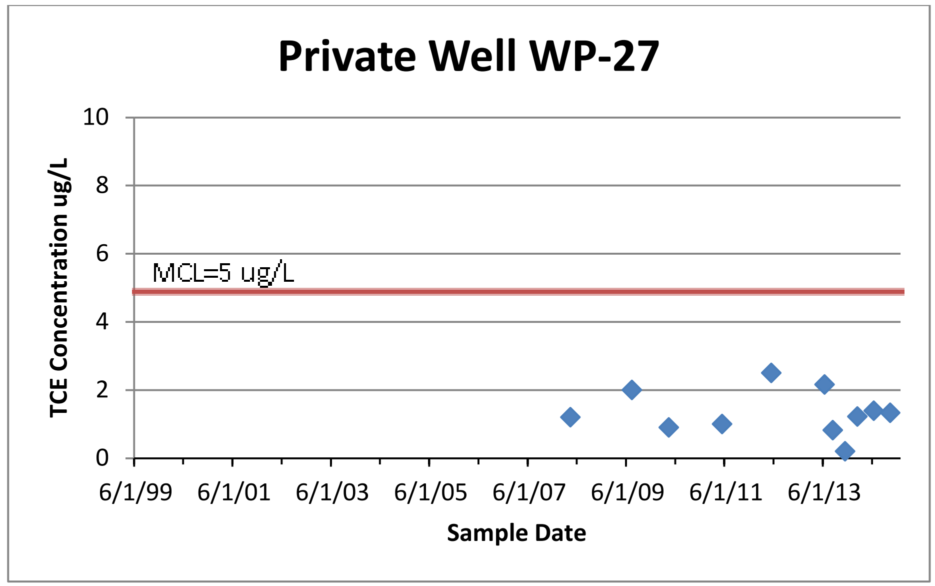

Monitoring Well 04CW07A
TCE Concentration (ug/L)
70
60
50
40
30
20
10
0
6/1/99
6/1/01
6/1/03
6/1/05
6/1/07
6/1/09
6/1/11
6/1/13
Sample Date

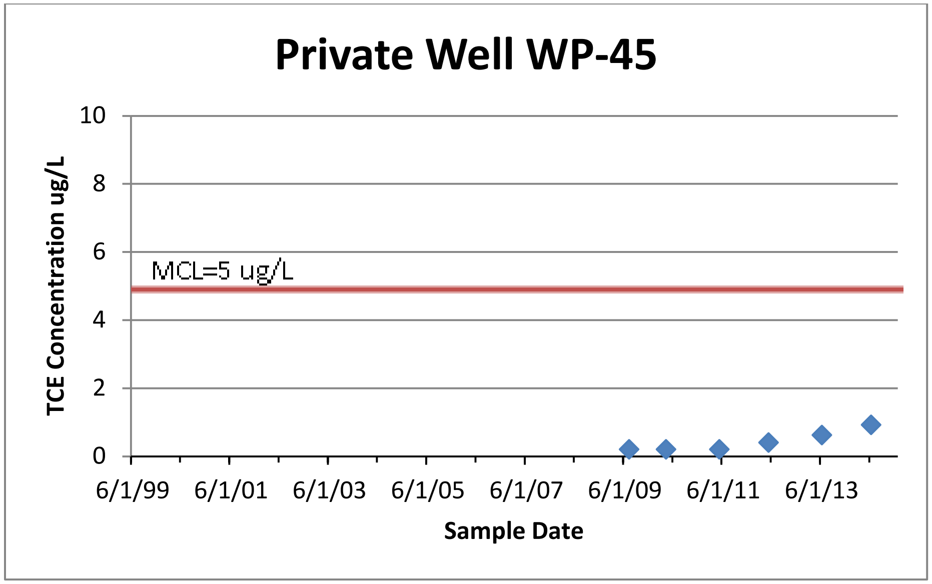

Monitoring Well 04CW07B
TCE Concentration (ug/L)
70
60
50
40
30
20
10
0
6/1/99
6/1/01
6/1/03
6/1/05
6/1/07
6/1/09
6/1/11
6/1/13
Sample Date


Private Well WP-03
TCE Concentration ug/L
MCL=5 ug/L
Sample Date
0
2
4
6
8
10
6/1/99
6/1/01
6/1/03
6/1/05
6/1/07
6/1/09
6/1/11
6/1/13

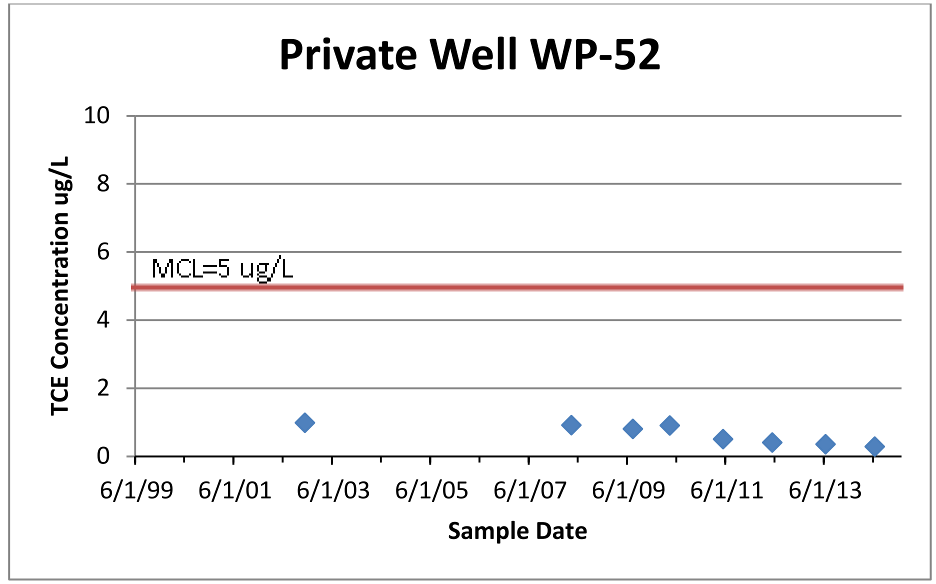

Private Well WP-04
TCE Concentration ug/L
MCL=5 ug/L
Sample Date
0
2
4
6
8
10
6/1/99
6/1/01
6/1/03
6/1/05
6/1/07
6/1/09
6/1/11
6/1/13


Private Well WP-18N
TCE Concentration ug/L
MCL=5 ug/L
Sample Date
0
2
4
6
8
10
6/1/99
6/1/01
6/1/03
6/1/05
6/1/07
6/1/09
6/1/11
6/1/13

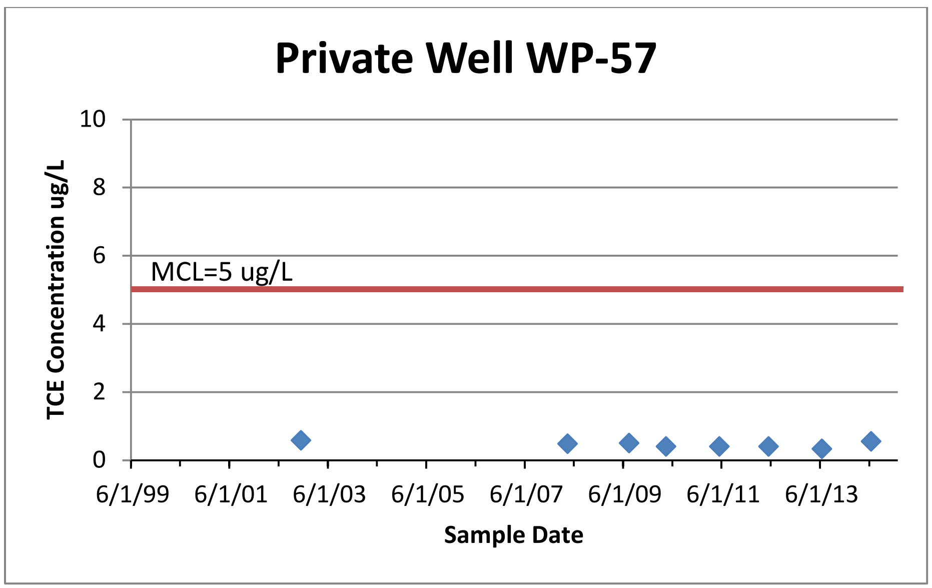

Private Well WP-27
TCE Concentration ug/L
MCL=5 ug/L
Sample Date
0
2
4
6
8
10
6/1/99
6/1/01
6/1/03
6/1/05
6/1/07
6/1/09
6/1/11
6/1/13



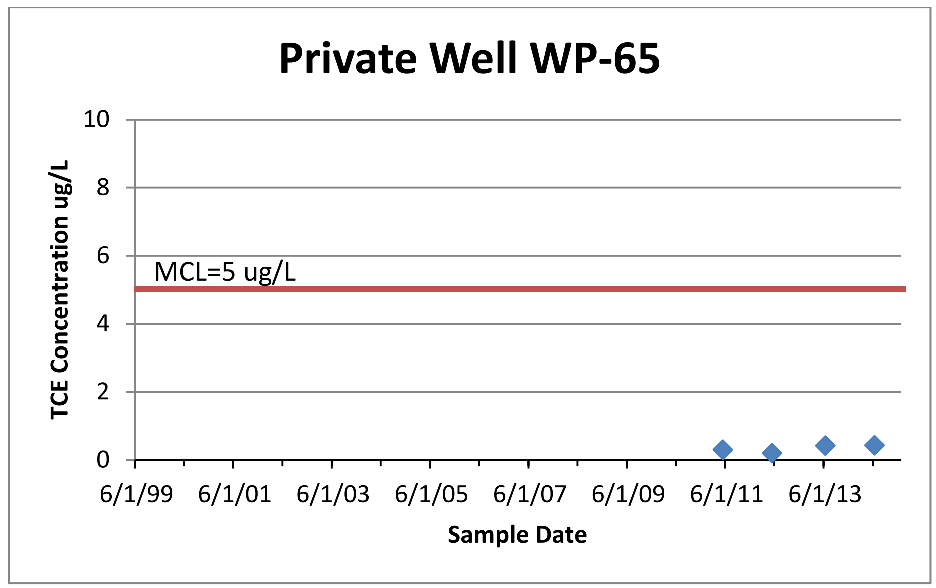
Private Well WP-45
TCE Concentration ug/L
10
8
6
4
2
0
MCL=5 ug/L
6/1/99 6/1/01 6/1/03 6/1/05 6/1/07 6/1/09 6/1/11 6/1/13
Sample Date



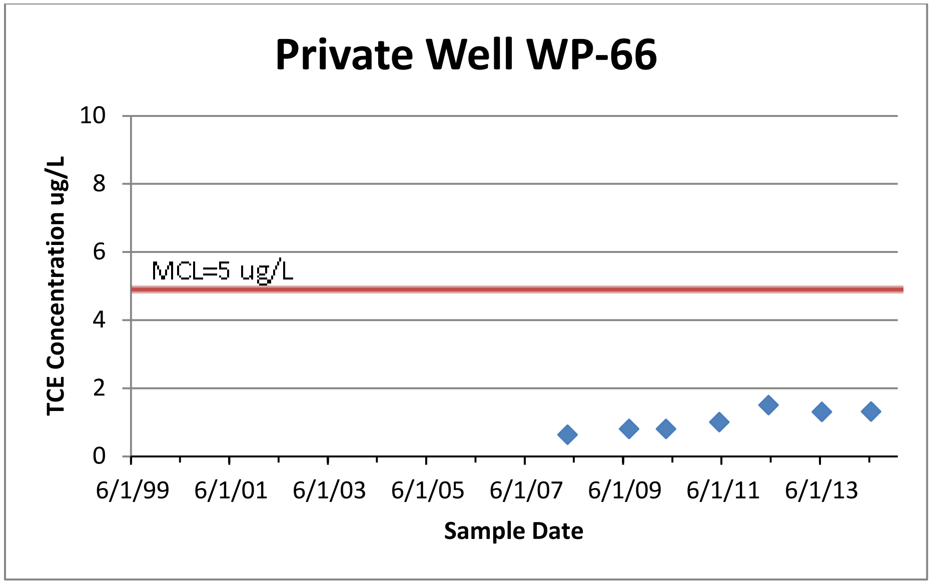
Private Well WP-52
TCE Concentration ug/L
10
8
6
4
2
0
MCL=5 ug/L
6/1/99 6/1/01 6/1/03 6/1/05 6/1/07 6/1/09 6/1/11 6/1/13
Sample Date

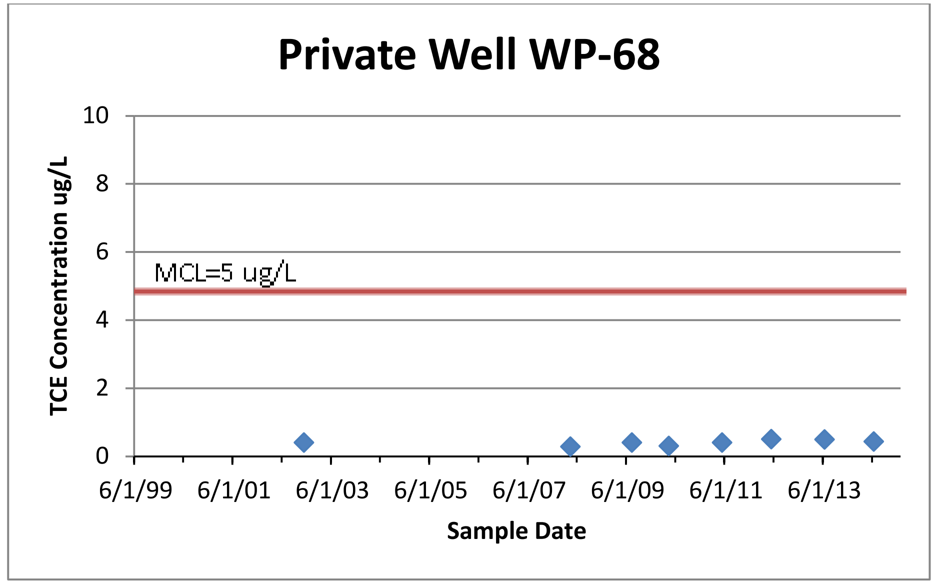


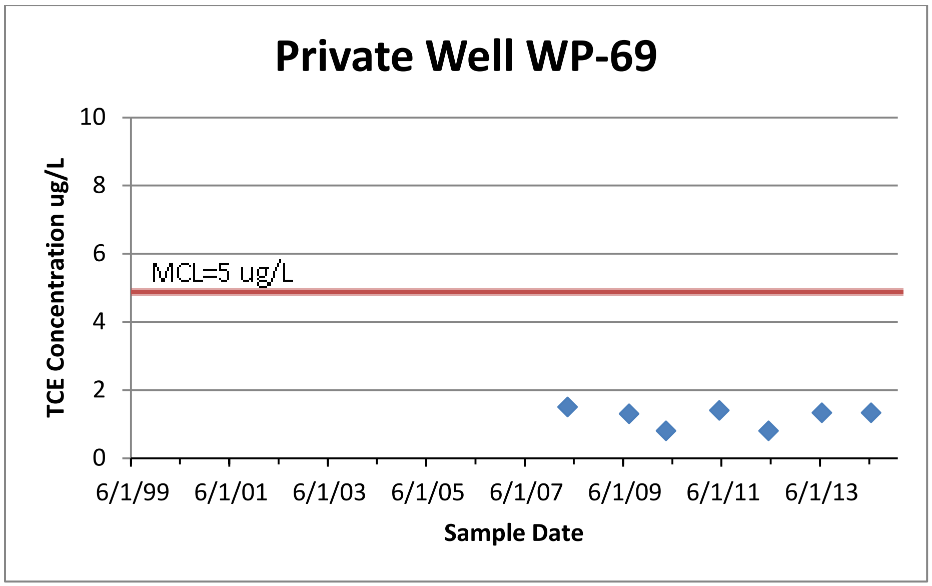
Private Well WP-57
TCE Concentration ug/L
10
8
6
4
2
0
MCL=5 ug/L
6/1/99 6/1/01 6/1/03 6/1/05 6/1/07 6/1/09 6/1/11 6/1/13
Sample Date

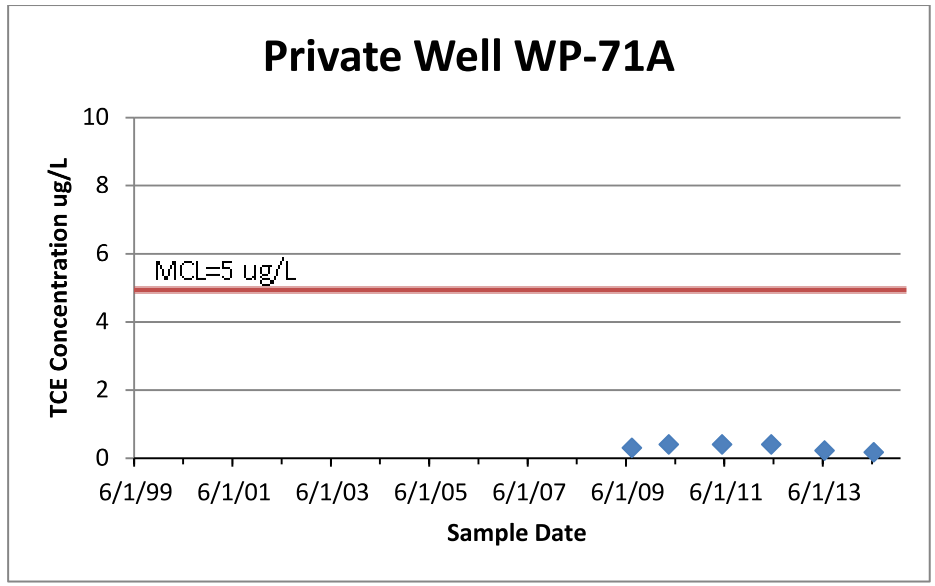


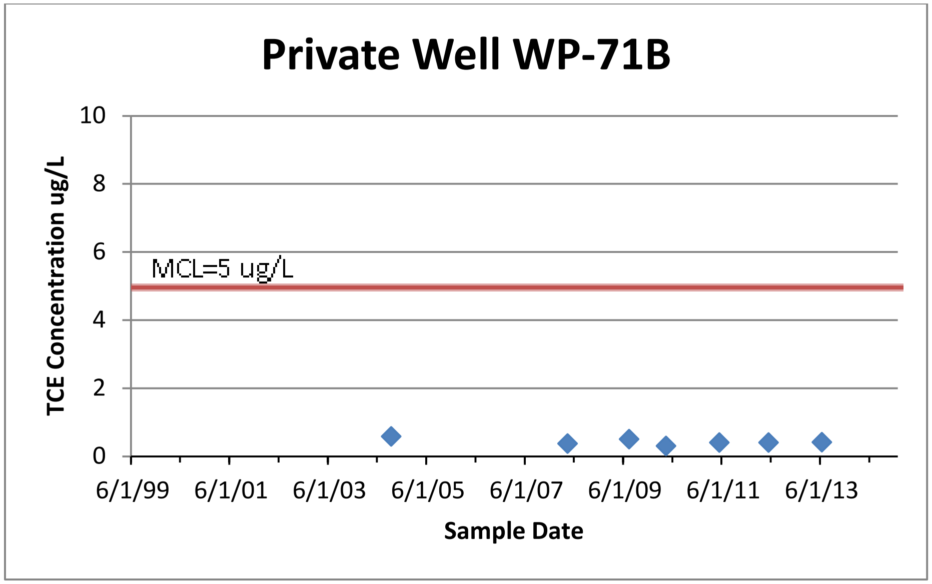
Private Well WP-65
TCE Concentration ug/L
10
8
6
4
2
0
MCL=5 ug/L
6/1/99 6/1/01 6/1/03 6/1/05 6/1/07 6/1/09 6/1/11 6/1/13
Sample Date

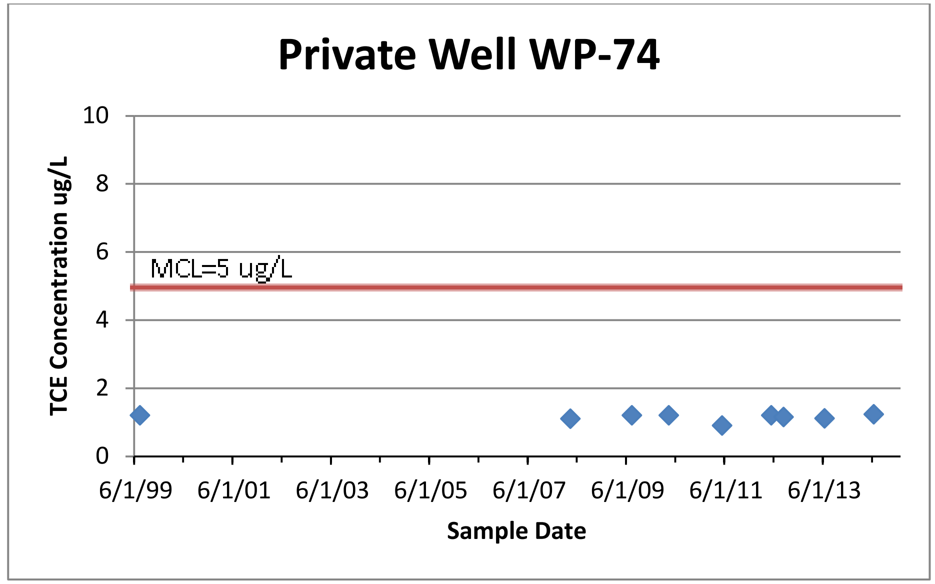

Private Well WP-66
TCE Concentration ug/L
MCL=5 ug/L
10
8
6
4
2
0
6/1/99
6/1/01
6/1/03
6/1/05
6/1/07
6/1/09
6/1/11
6/1/13
Sample Date

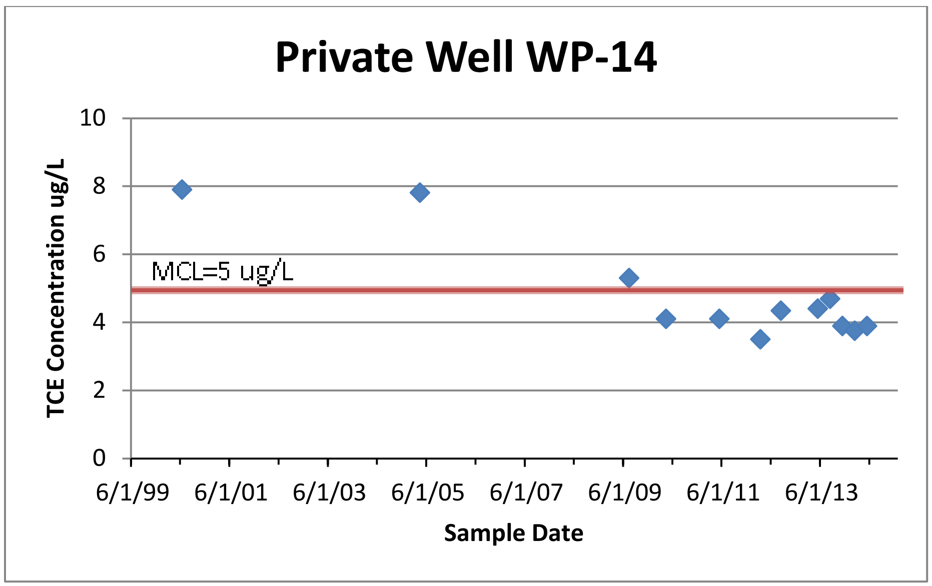

Private Well WP-68
TCE Concentration ug/L
MCL=5 ug/L
10
8
6
4
2
0
6/1/99
6/1/01
6/1/03
6/1/05
6/1/07
6/1/09
6/1/11
6/1/13
Sample Date

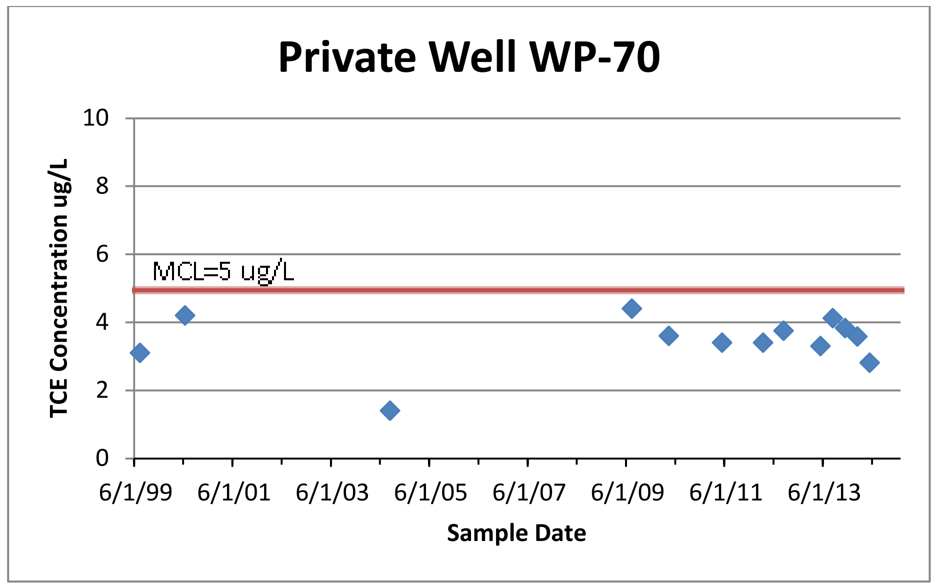

Private Well WP-69
TCE Concentration ug/L
MCL=5 ug/L
10
8
6
4
2
0
6/1/99
6/1/01
6/1/03
6/1/05
6/1/07
6/1/09
6/1/11
6/1/13
Sample Date

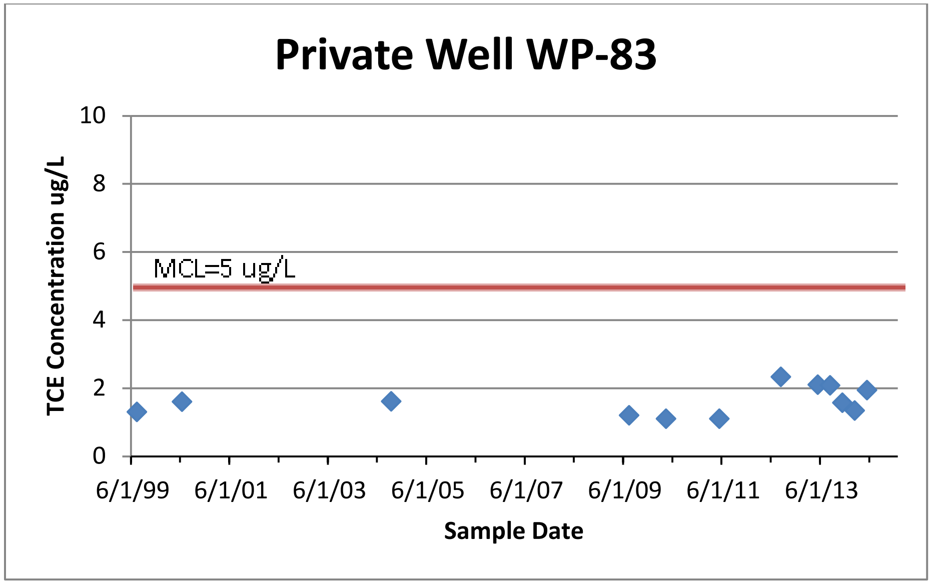

Private Well WP-71A
TCE Concentration ug/L
MCL=5 ug/L
10
8
6
4
2
0
6/1/99
6/1/01
6/1/03
6/1/05
6/1/07
6/1/09
6/1/11
6/1/13
Sample Date

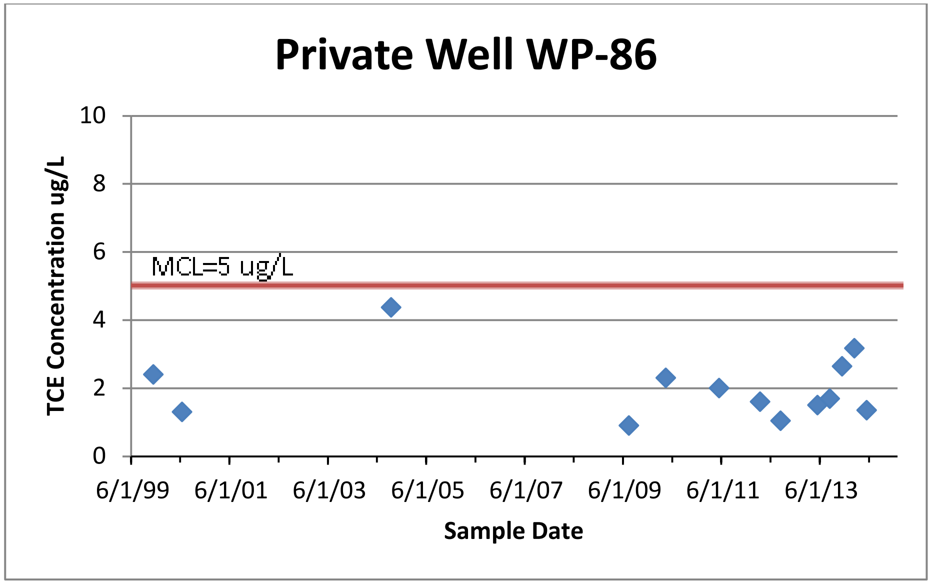

Private Well WP-71B
TCE Concentration ug/L
10
8
6
4
2
0
MCL=5 ug/L
6/1/99
6/1/01
6/1/03
6/1/05
6/1/07
6/1/09
6/1/11
6/1/13
Sample Date

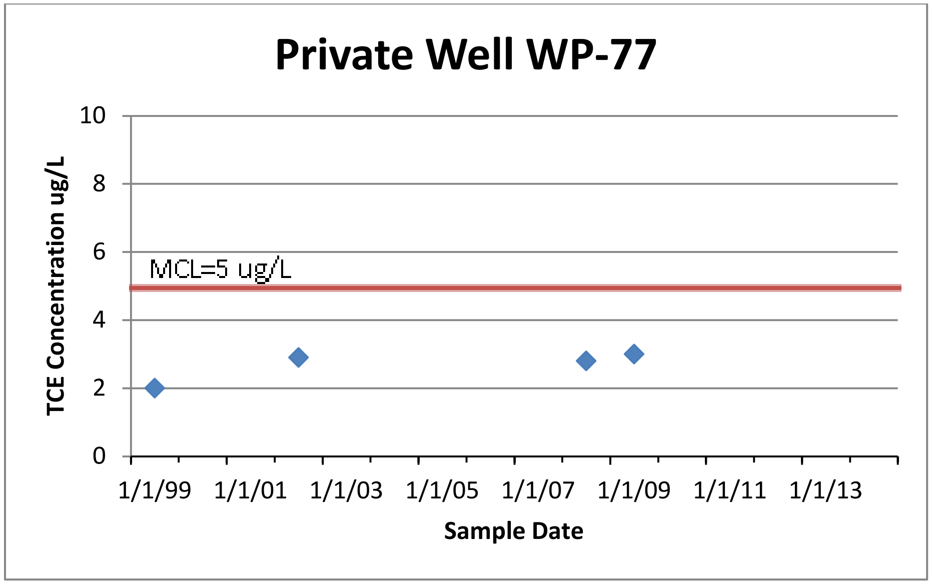

Private Well WP-74
TCE Concentration ug/L
10
8
6
4
2
0
MCL=5 ug/L
6/1/99
6/1/01
6/1/03
6/1/05
6/1/07
6/1/09
6/1/11
6/1/13
Sample Date

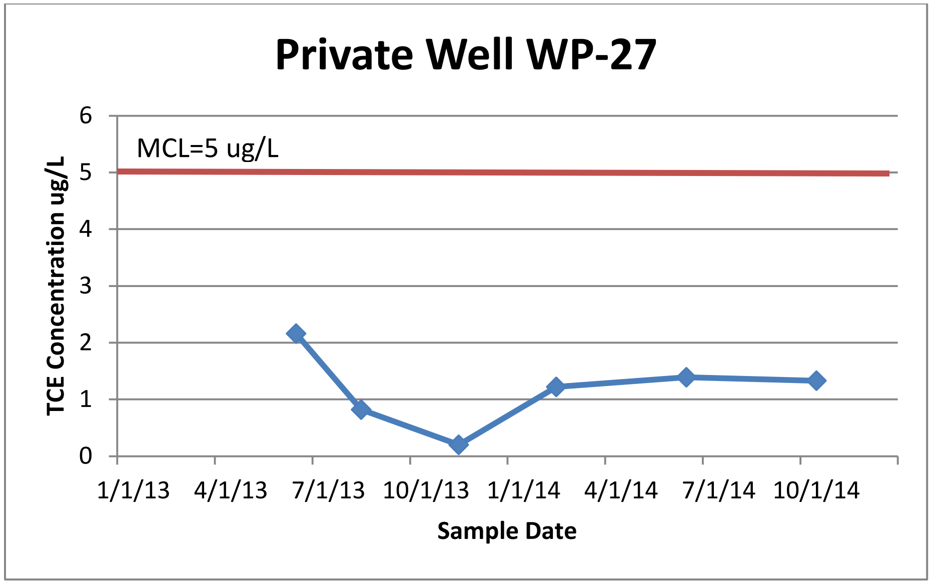

Private Well WP-14
TCE Concentration ug/L
10
8
6
4
2
0
MCL=5 ug/L
6/1/99
6/1/01
6/1/03
6/1/05
6/1/07
6/1/09
6/1/11
6/1/13
Sample Date

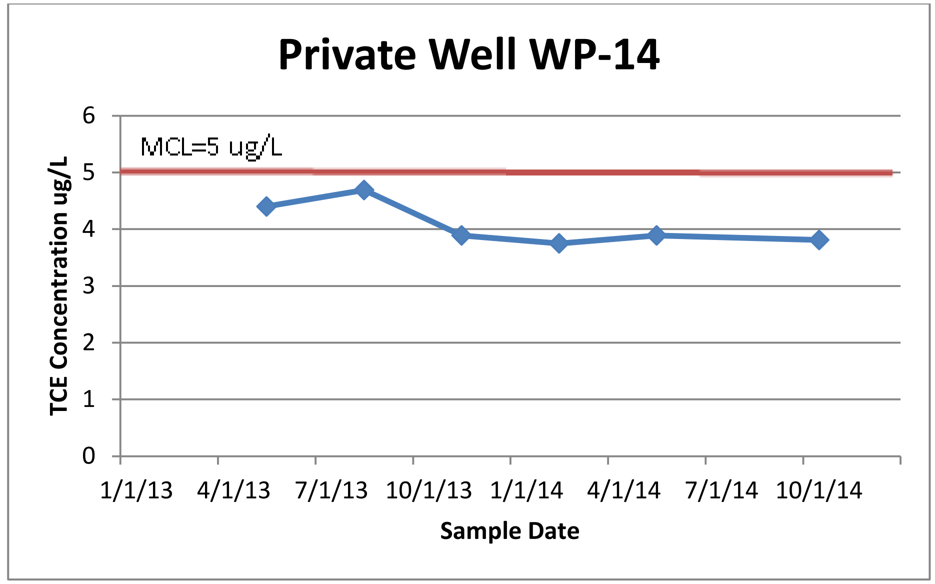

Private Well WP-70
TCE Concentration ug/L
10
8
6
4
2
0
MCL=5 ug/L
6/1/99
6/1/01
6/1/03
6/1/05
6/1/07
6/1/09
6/1/11
6/1/13
Sample Date

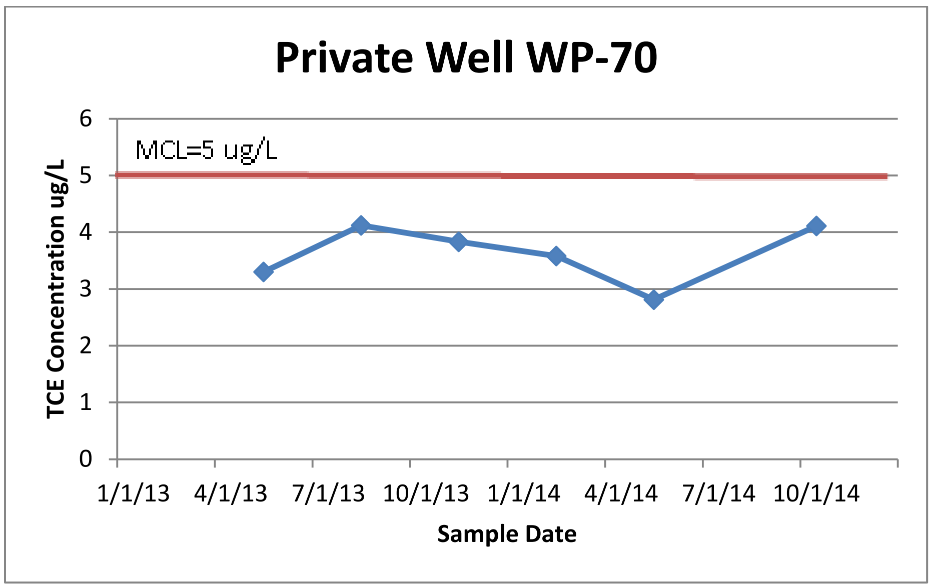

Private Well WP-83
TCE Concentration ug/L
10
8
6
4
2
0
MCL=5 ug/L
6/1/99
6/1/01
6/1/03
6/1/05
6/1/07
6/1/09
6/1/11
6/1/13
Sample Date

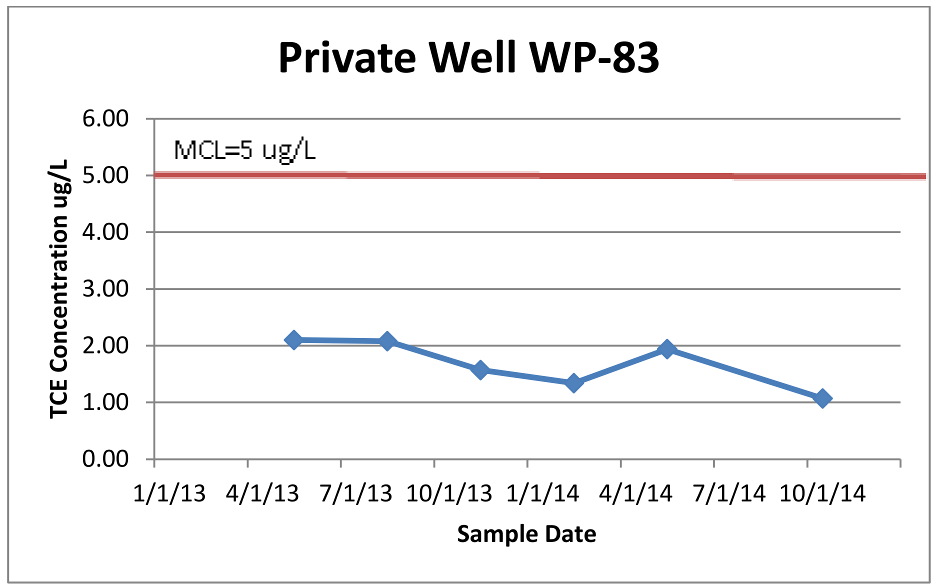

Private Well WP-86
TCE Concentration ug/L
10
8
6
4
2
0
MCL=5 ug/L
6/1/99
6/1/01
6/1/03
6/1/05
6/1/07
6/1/09
6/1/11
6/1/13
Sample Date

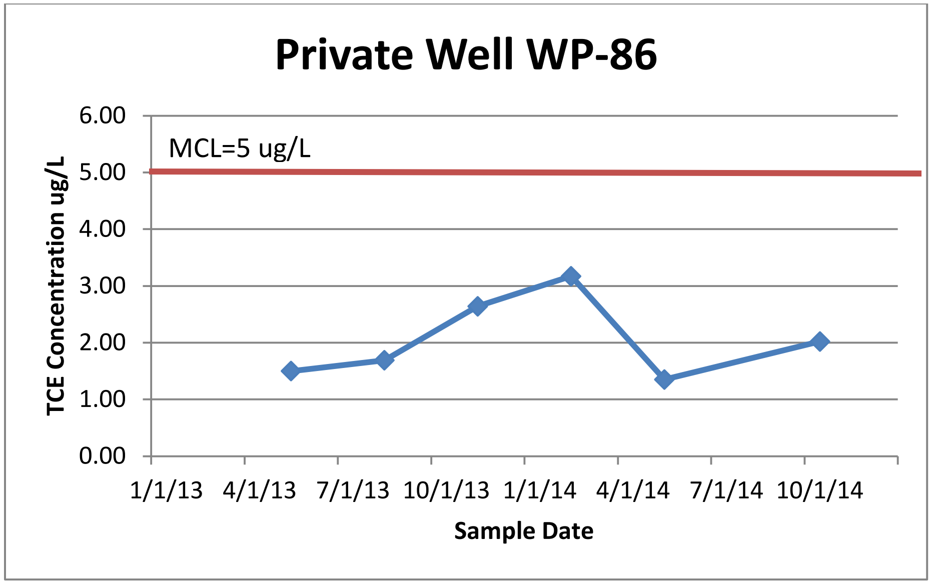

Private Well WP-77
TCE Concentration ug/L
10
8
6
4
2
0
MCL=5 ug/L
1/1/99
1/1/01
1/1/03
1/1/05
1/1/07
1/1/09
1/1/11
1/1/13
Sample Date

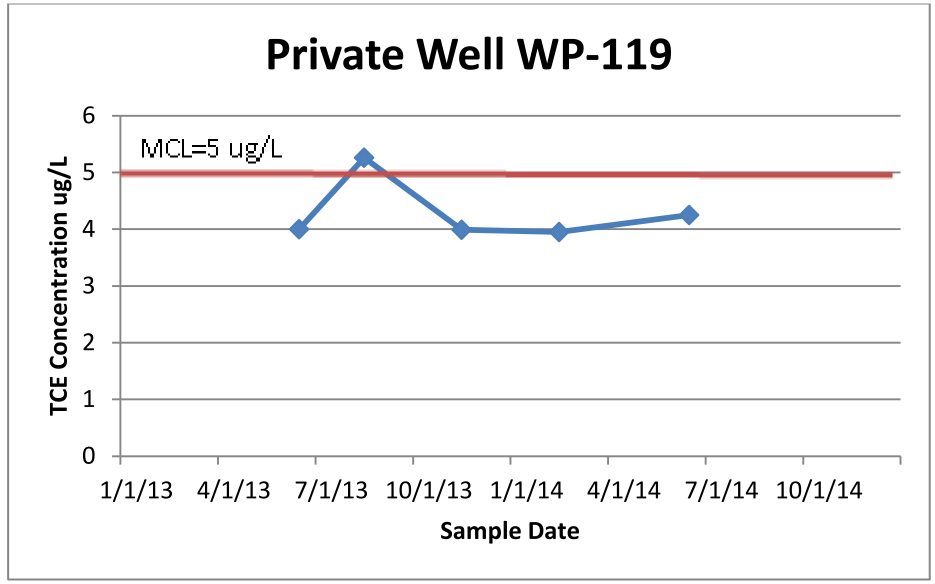

Private Well WP-27
TCE Concentration ug/L
MCL=5 ug/L
0
1
2
3
4
5
6
1/1/13
4/1/13
7/1/13
10/1/13
1/1/14
4/1/14
7/1/14
10/1/14
Sample Date

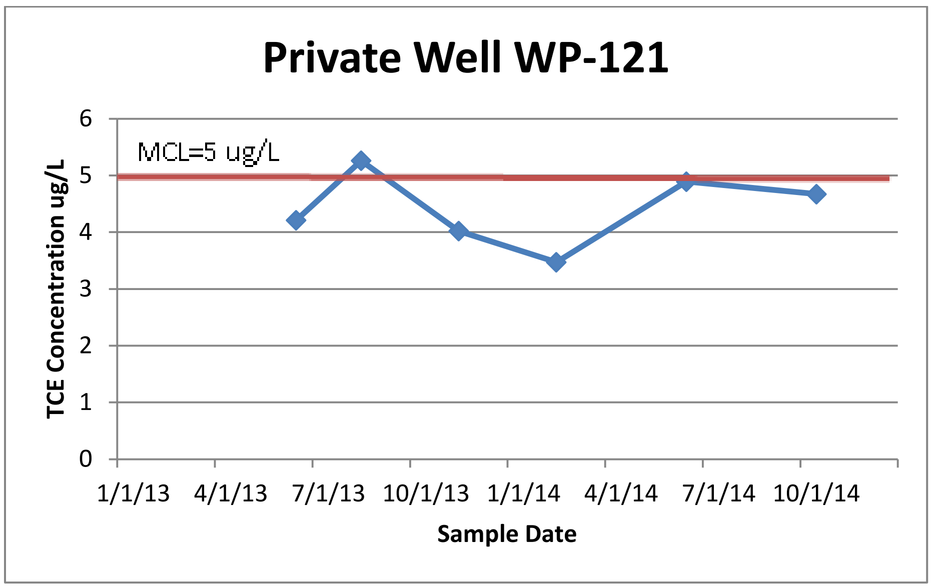

Private Well WP-14
TCE Concentration ug/L
MCL=5 ug/L
0
1
2
3
4
5
6
1/1/13
4/1/13
7/1/13
10/1/13
1/1/14
4/1/14
7/1/14
10/1/14
Sample Date

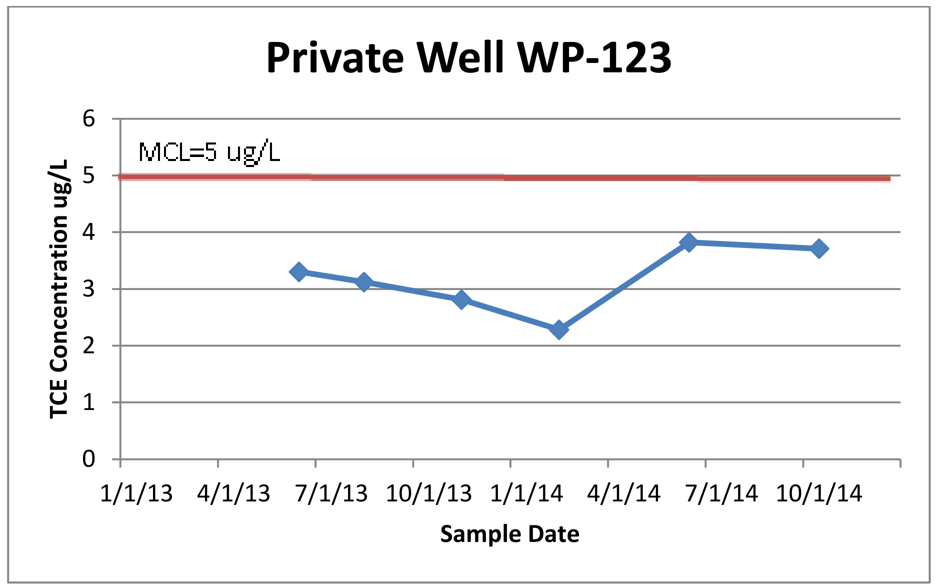

Private Well WP-70
TCE Concentration ug/L
MCL=5 ug/L
0
1
2
3
4
5
6
1/1/13
4/1/13
7/1/13
10/1/13
1/1/14
4/1/14
7/1/14
10/1/14
Sample Date

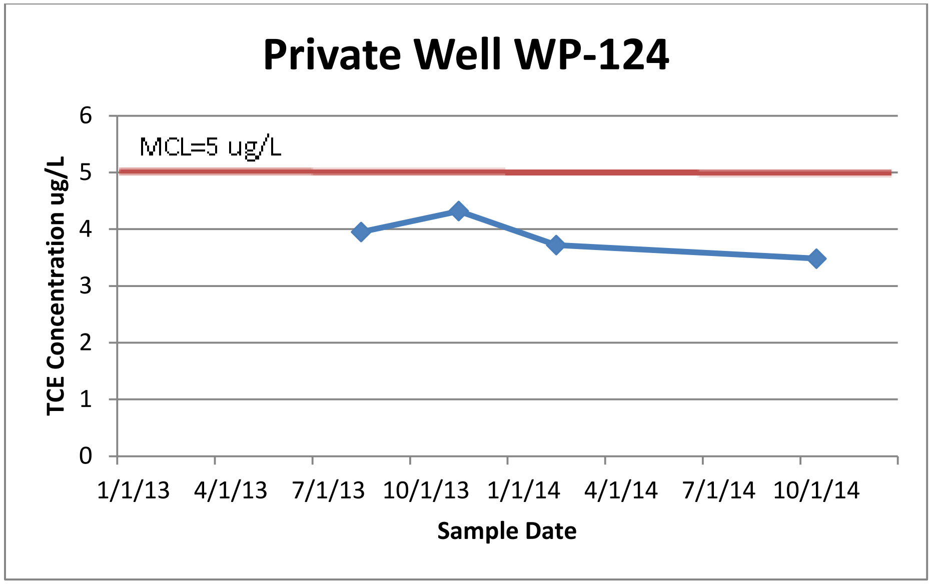

Private Well WP-83
TCE Concentration ug/L
MCL=5 ug/L
0.00
1.00
2.00
3.00
4.00
5.00
6.00
1/1/13
4/1/13
7/1/13
10/1/13
1/1/14
4/1/14
7/1/14
10/1/14
Sample Date

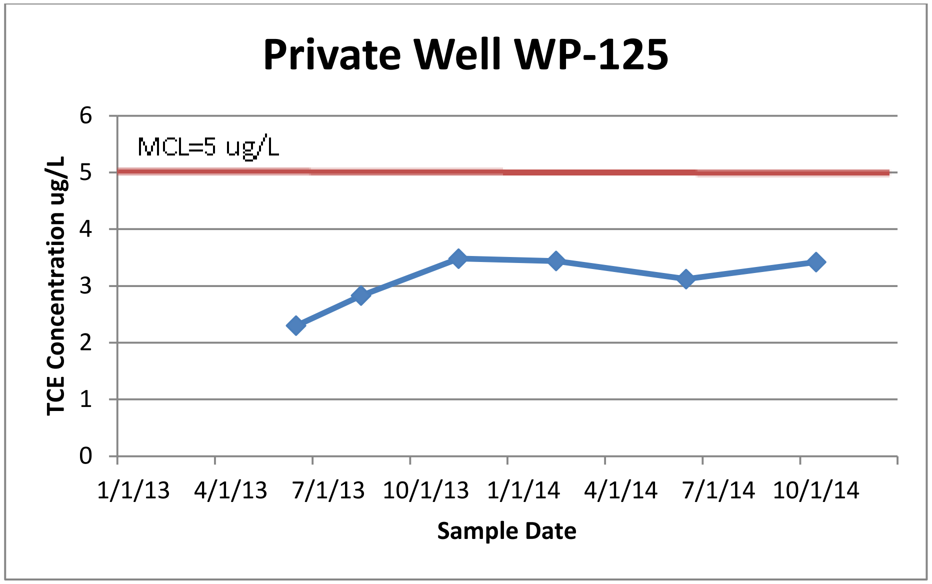

Private Well WP-86
MCL=5 ug/L
TCE Concentration ug/L
6.00
5.00
4.00
3.00
2.00
1.00
0.00
1/1/13
4/1/13
7/1/13
10/1/13
1/1/14
4/1/14
7/1/14
10/1/14
Sample Date

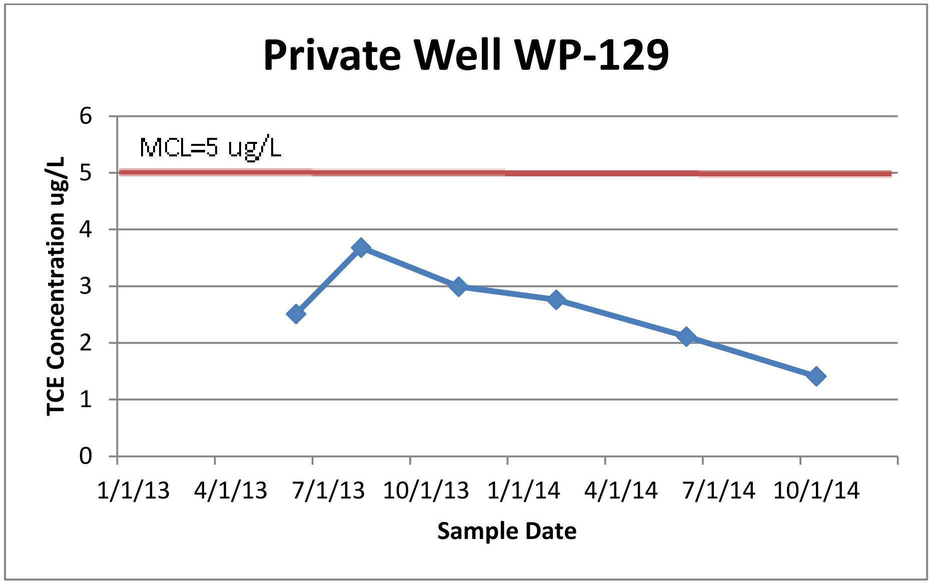

Private Well WP-119
MCL=5 ug/L
TCE Concentration ug/L
6
5
4
3
2
1
0
1/1/13
4/1/13
7/1/13
10/1/13
1/1/14
4/1/14
7/1/14
10/1/14
Sample Date

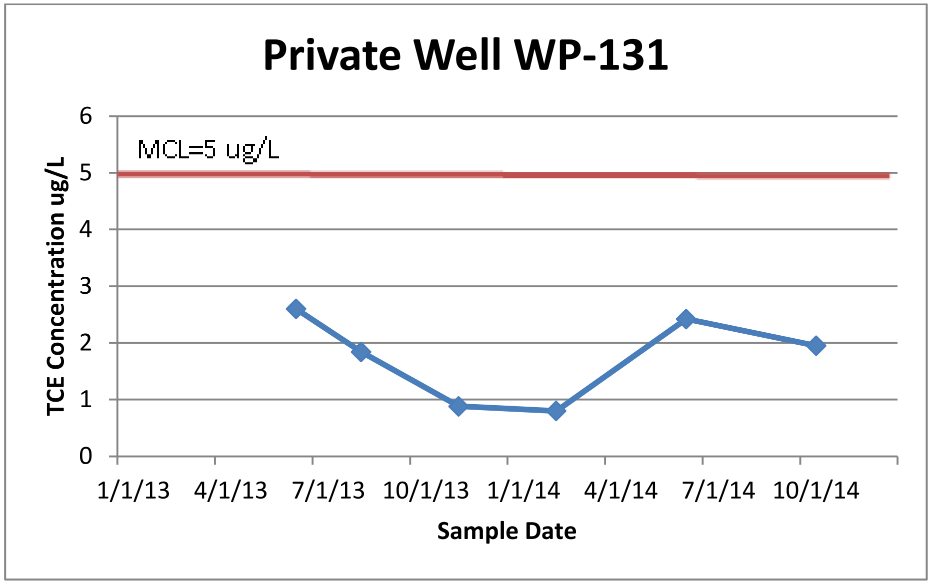

Private Well WP-121
MCL=5 ug/L
TCE Concentration ug/L
6
5
4
3
2
1
0
1/1/13
4/1/13
7/1/13
10/1/13
1/1/14
4/1/14
7/1/14
10/1/14
Sample Date

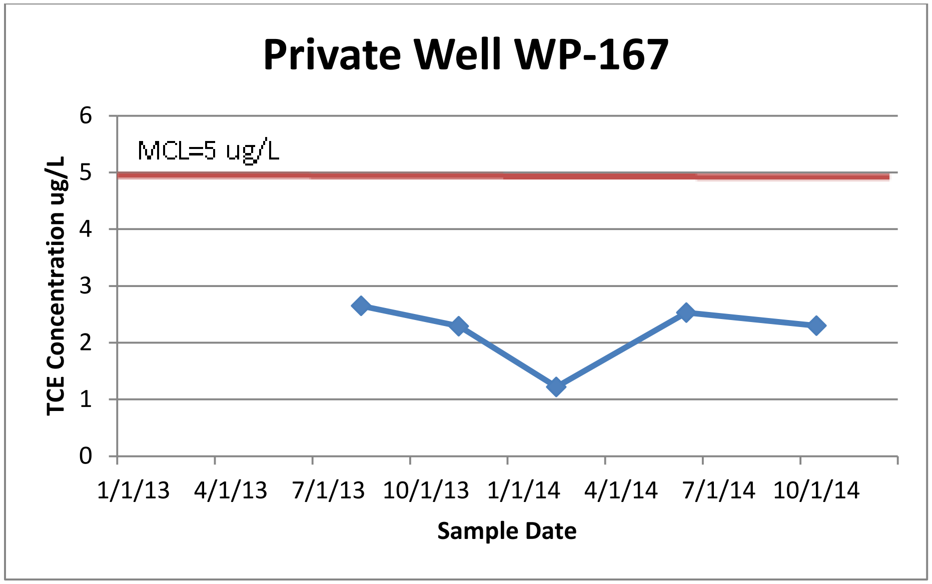

Private Well WP-123
MCL=5 ug/L
TCE Concentration ug/L
6
5
4
3
2
1
0
1/1/13
4/1/13
7/1/13
10/1/13
1/1/14
4/1/14
7/1/14
10/1/14
Sample Date

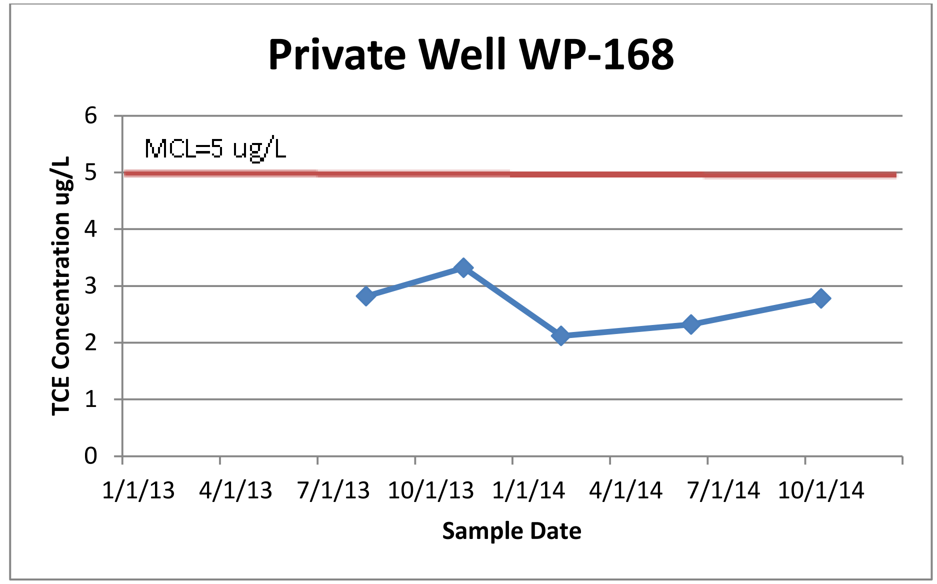

Private Well WP-124
MCL=5 ug/L
TCE Concentration ug/L
0
1
2
3
4
5
6
1/1/13 4/1/13 7/1/13 10/1/13 1/1/14 4/1/14 7/1/14 10/1/14
Sample Date


Private Well WP-125
MCL=5 ug/L
TCE Concentration ug/L
0
1
2
3
4
5
6
1/1/13 4/1/13 7/1/13 10/1/13 1/1/14 4/1/14 7/1/14 10/1/14
Sample Date


Private Well WP-129
MCL=5 ug/L
TCE Concentration ug/L
0
1
2
3
4
5
6
1/1/13 4/1/13 7/1/13 10/1/13 1/1/14 4/1/14 7/1/14 10/1/14
Sample Date


Private Well WP-131
MCL=5 ug/L
TCE Concentration ug/L
0
1
2
3
4
5
6
1/1/13 4/1/13 7/1/13 10/1/13 1/1/14 4/1/14 7/1/14 10/1/14
Sample Date


Private Well WP-167
MCL=5 ug/L
TCE Concentration ug/L
0
1
2
3
4
5
6
1/1/13
4/1/13
7/1/13
10/1/13
1/1/14
4/1/14
7/1/14
10/1/14
Sample Date


Private Well WP-168
MCL=5 ug/L
TCE Concentration ug/L
0
1
2
3
4
5
6
1/1/13
4/1/13
7/1/13
10/1/13
1/1/14
4/1/14
7/1/14
10/1/14
Sample Date

APPENDIX E - Laboratory Data Packages (CD only)

APPENDIX F -Quality Control Summary Report

QUALITY CONTROL SUMMARY REPORT

2014

MOSES LAKE WELLFIELD SUPERFUND SITE

GROUNDWATER MONITORING AND WHOLE HOUSE FILTER PROGRAM

MOSES LAKE, WASHINGTON

CERCLIS ID# WA988466355

Prepared by

U.S. ARMY CORPS OF ENGINEERS

SEATTLE DISTRICT

4735 East Marginal Way South

Seattle, Washington 98134

Prepared for

U.S. ENVIRONMENTAL PROTECTION AGENCY

REGION 10

1200 6th Avenue

Seattle, Washington 98101

February 2015

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Contents

Acronyms and Abbreviations

ADR	Automated Data Review
DOD	Department of Defense
eQAPP	Electronic Quality Assurance Project Plan
EPA	U.S. Environmental Protection Agency
LCS	Laboratory Control Sample
LCSD	Laboratory Control Sample Duplicate
MS	Matrix Spike
MSD	Matrix Spike Duplicate
PCB	Polychlorinated biphenyls
QAPP	Quality Assurance Project Plan
QC	Quality Control
QSM	Quality Systems Manual
RPD	Relative Percent Difference
SDG	Sample Delivery Group
TCMX	Tetrachloro-m-xylene
TOC	Total Organic Carbon
USACE	U.S. Army Corps of Engineers Seattle District
%R	Percent Recovery
mg/L	Milligrams per liter
ug/L	Micrograms per liter

1 Introduction

This Quality Control Summary Report (QCSR) presents Stage 2a and Stage 4 data validation results for samples collected during the November 2013 through September 2014 sampling period. Data validation was performed in accordance with the Moses Lake Wellfield Groundwater Monitoring and Whole House Filter Program Quality Assurance Project Plan and Addendum - for Moses Lake Superfund Site, Moses Lake, Washington (QAPP) (USACE, May 2014), U.S. Department of Defense Quality Systems Manual for Environmental Laboratories, Version 5.0 (DOD QSM) (DoD, July 2013), and Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review (CLPNFG) (USEPA, June 2008). Laboratory Data Consultants, Inc., an independent subcontractor to the U.S. Army Corps of Engineers, Seattle District (USACE), performed the data validation task.

This QCSR was based on the outcome of the data review and data validation performed on all five laboratory reports submitted by Analytical Resources, Inc. in Tukwila, WA.

The purpose of this QCSR is to provide the project management and data end-users (1) an overview of data quality in terms of precision, accuracy, representativeness, comparability, sensitivity, and completeness, (2) specific data quality anomalies and their effects on data usability, and (3) recommendations to the extent of data usage.

Following the requirements outlined in the QAPP, samples were analyzed with analytical protocols defined in:

- Measurement of Purgeable Organic Compounds in Water by Capillary Column Gas Chromatography/Mass Spectrometry (Method 524.3) EPA 815-B-09-009, June 2009.

2 Quality Control Activities

Two thousand nine hundred forty-three (2,943) groundwater samples were collected during the November 2013 through September 2014 sampling events. The samples were analyzed for volatile organic compounds (VOCs). The sample identification, collection dates, analyses requested/performed, and validation levels and well identification numbers (IDs) are presented in the DVR attachments.

All sample results were subjected to Stage 2a data validation, which consists of an evaluation of quality control (QC) summary results for sample holding times, surrogates, matrix spike/matrix spike duplicates (MS/MSD), laboratory control sample/laboratory control sample duplicates (LCS/LCSD), method blanks, trip blanks, field blanks, equipment blanks, and field duplicate samples.

A Stage 4 evaluation of the quality control (QC) summary forms as well as initial and continuing calibrations and the raw data was performed on 10 percent (overall) of VOCs by EPA Test Method 524.3 to confirm sample quantitation and identification.

Based on the data review, the chain-of-custody (COC) forms and sample receipt forms submitted in the analytical reports were clear and complete in all cases. Cooler temperatures were within the 4±2°C criteria.

3 Data Quality Assessment

Based on the outcomes of the data validation, the following sections evaluate if the quality of the data collected during this sampling event achieves the data quality objectives (DQOs) specified in the QAPP. Data quality was determined based on various quality measures commonly referred to as data quality indicators (DQIs) - precision, accuracy/bias, representativeness, comparability, completeness and sensitivity (quantitation limits).

3.1 Data Quality Indicators

Data quality indicators are defined in the following sections. Quality control (QC) parameters evaluated in the data review/validation and the corresponding DQIs are presented as attachments to the DVRs. Definitions of the data quality indicators are provided as follows:

3.1.1 Precision

Precision is defined as the degree of mutual agreement among independent measurements as the result of repeated application of the same process under similar conditions. Analytical precision is evaluated via the relative percent difference (RPD) values of matrix spike/matrix spike duplicate (MS/MSD) and laboratory control sample/ laboratory control sample duplicate (LCS/LCSD). The RPD values of field duplicate analyses represent the combined precision of sample collection and analysis procedures, as well as sample heterogeneity.

3.1.2 Accuracy

Accuracy is a statistical measurement of correctness and includes components of random and systematic errors. It is quantified as the degree of agreement between a measurement with a known reference. Analytical accuracy is evaluated via the percent recovery (%R) values of initial and continuing calibration (percent difference [%D] or percent drift [%Df]), internal standards, surrogate spikes, MS/MSD, LCS/LCSD, in conjunction with method blank, trip blank, and field blank results. Results of blanks assist in identifying the type and magnitude of effects contributed to the system error introduced via field and/or laboratory procedures.

3.1.3 Representativeness

Representativeness is the level of confidence that the analytical data reflects the actual field condition. Representativeness is ensured by maintaining sample integrity during collection, preparation, and analysis. The evaluation of associated method, trip, and field blanks also assists in identifying artifacts that may skew the representativeness of the samples.

3.1.4 Comparability

Comparability is the confidence with which one data set can be compared to another data set. Using standard methods throughout the data generation processes ensures the comparability of data generated in separate sampling days or events.

3.1.5 Completeness

Completeness is a measure of the amount of valid data obtained from a measurement system compared to the amount that was expected to be obtained under normal conditions. Data is complete and valid if it meets all acceptance criteria including accuracy, precision, and any other criteria specified by the particular analytical method being used. Four calculations of completeness are specified in the project QAPP.

Contract compliance completeness falling below the target level may result in the issuance of a corrective action request for the project laboratory. Contract compliance failures are usually the result of lack of corrective action. The impact of contract compliance deficiencies varies with the specific correction action failure and is be determined during the data usability assessment.

$$\textit{Contract Completeness} = \frac{\#\ \textit{contract compliant results} \times 100\%}{\#\ \textit{results reported}}$$

Analytical completeness is used to assess the laboratories ability to generate high quality data. This may be a reflection of contract compliance or other issues and requires detail assessment of the cause for qualification during data usability assessment.

$$\textit{Analytical Completeness} = \frac{\#\ \textit{unqualified results}}{\#\ \textit{results reported}} \times 100\%$$

(Estimated results are considered as useable for project decision making.)

Technical completeness is a measure which reflects the laboratories ability to produce usable results. The impact of failure to meet this goal will results in serious impacts to data usability (rejected results) and may result in termination of the contract.

$$\textit{Technical Completeness} = \frac{\#\ \textit{useable results}^{\dagger}}{\#\ \textit{results reported}} \times 100\%$$

Field sampling completeness reflects whether the samples planned for collection were actually acquired.

$$\textit{Field Sampling Completeness} = \frac{\#\ \textit{samples collected}}{\#\ \textit{samples planned}} \times 100\%$$

The minimum goals for completeness are as follows: 1) Contract = 100%, 2) Analytical = 90% or greater, 3) Technical = 90% or greater and 4) Field = 100%. The goal for holding times is 100%. Estimated results are treated as usable results for technical completeness. These are considered minimum goals.

3.1.6 Sensitivity

Sensitivity depicts the level of ability an analytical system (i.e., sample preparation and instrumental analysis) of detecting a target component in a given sample matrix with a defined level of confidence. Factors affecting the sensitivity of an analytical system include: analytical system background (e.g., laboratory artifact or method blank contamination), sample matrix (e.g., mass spectrometry ion ratio change, co-elution of peaks, or baseline elevation), instrument instability, and field procedures (including sample transport).

To evaluate if the analytical sensitivity achieved the project expectation, sample-specific project quantitation limits (PQLs) were compared against the reporting limit (RL) goals set forth in the QAPP. In addition, sample results were compared to detections of target analytes in method blanks, and trip blanks to identify potential effects of laboratory background and field procedures on sensitivity.

3.2 Data Quality Indicator Evaluation

The following subsections present an evaluation of the data. The assessment is intended to reconcile the existing data quality with the project DQOs. Assessment is presented herein in terms of the data quality indicators. The qualified data are presented in the DVR attachments.

DQIs for VOC data met the project goals with the following exceptions:

Precision – The following outliers represent potential precision outliers.

- Three MS/MSD pairs exceeded the RPD acceptance criteria for 1,1-dichloroethene, 1,2-dichloroethane, cis-1,2-dichloroethene, trans-1,2-dichloroethene and trichloroethene. The trichloroethene results in sample 14MLW0627N12BW02 was qualified as estimated (J+) for detects due to MS/MSD RPD above acceptance limits. No Data were qualified when the associated results were non-detected. (See May/June 2014 DVR.)

MS/MSD outlier reports can be found in the DVR attachments.

Accuracy/Bias – The following QC outliers indicate potential bias of VOC data:

- One MS/MSD pair exceeded the %R acceptance criteria for 1,1,1-trichloroethane, 1,2-dichloroethane and vinyl chloride. No data were qualified due to high %R when the associated results were non-detected. (See February 2014 DVR.)
- Three MS/MSD pairs exceeded the %R acceptance criteria for 1,1-dichloroethene, 1,2-dichloroethane, cis-1,2-dichloroethene, trans-1,2-dichloroethene and trichloroethene. The trichloroethene result in sample 14MLW0627N12BW02 was qualified as estimated (J+) for detects due to MS/MSD %Rs outside acceptance limits. No Data were qualified when the associated results were non-detected. (See May/June 2014 DVR.)
- Two LCS/LCSD pairs exceeded the %R acceptance criteria for 1,1-dichloroethene and vinyl chloride. Thirty-eight results were qualified as estimated (UJ) for non-detects due to LCS/LCSD %R outside of acceptance limits. (See September 2014 DVR.)

MS/MSD and LCS/LCSD outlier reports can be found in the DVR attachments.

Representativeness – The following QC outliers indicate potential impact on sample representativeness:

- Samples 14MLW0622N12BW05 and 14MLW0622n12BW07 exceeded the 14-day analysis acceptance criteria. The trichloroethene results in these samples were qualified as estimate (J-) for detects due to holding time exceedances. (See May/June 2014 DVR.)

See May through June DVR Attachment 4 for holding time outlier reports.

Completeness – The following list represents completeness outliers for the VOC data:

- The contract completeness level attained for field samples was 99.4%. Due to quality control exceedances, 10 out of 1664 results were qualified as estimated (J). (See May/June 2014 DVR.)
- The contract compliance completeness for field samples was 99.7%. Due to quality control exceedances, 1 out of 296 results were qualified as estimated. (See November 2013 DVR.)

See the DVRs for full completeness reports of each sampling event.

Sensitivity – The target quantitation limits generally meet QAPP requirements. The following exception was noted:

- Target compounds detected below the limit of quantitation (flagged J by the laboratory) should be considered estimated.

Reporting limit outliers are presented in the DVR attachments.

4 Performance Evaluation Samples

One PE sample (MLW0619PE01) was submitted to the laboratory and analyzed for the purpose of evaluating the accuracy of the performance of the measurement or analytical procedures used by the laboratory. (See May/June 2014 DVR.)

All results were within the acceptance limits. Additional detail can be found in the DVRs.

5 Data Usability

The overall quality of the data is acceptable. All project DQIs were met with the exception of those noted above. All sample preservation requirements and all holding times were met. All instrument performance checks and calibrations were performed as required. All calibration factors and internal standard percent recoveries were within acceptance criteria. All surrogate, MS/MSD and LCS/LCSD percent recoveries and RPDs were within acceptance criteria with the exception described in Section 3.2.1. Method blanks, trip blanks, and field blanks were performed at the required frequency and no contamination was detected. Field duplicates were collected at the required frequency and the precision was considered acceptable. Therefore, all data are considered usable with consideration of their data review qualifiers.

6 References

DoD, 2010, Department of Defense Quality Systems Manual for Environmental Laboratories, Version 5.0, July 2013.

EPA, 2008, Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review, USEPA-540-R-08-01, Washington, D.C.

EPA, 2009, Guidance for Labeling Externally Validated Laboratory Analytical Data for Superfund Use, January 2009, EPA 540-R-08-005, Washington, D.C.

Laboratory Data Consultants, Inc., 2006, Automated Data Review, Version 1.5.0.160.

USACE, 2014, Moses Lake Wellfield Groundwater and Whole House Filter Monitoring Program Quality Assurance Project Plan.

EPA, 2009, Measurement of Purge able Organic Compounds in Water by Capillary Column Gas Chromatography/Mass Spectrometry: Method 524.3 Version 1, June 2009. USEPA-815-B-09-009. Cincinnati, OH

APPENDIX G – Data Validation Report (CD only)

APPENDIX H – Washington Department of Ecology - New Well Query

TEXT SEARCH RESULTS

Back   New Search

- **Search Criteria Used:** Township: 19N, Range: 28E, Section(s): 4 5 6 7 8 9 16 17 18, Completed From: 01/01/2013, Completed To: 12/15/2014, Received From: 01/01/2013, Received To: 12/15/2014
- There are 8 well logs that match your search criteria.
- The results are sorted by Well Owner Name

Download all 8 images | Download all 8 data records | Print this page | Help

Displaying 1 - 8 of 8 well log results   Sort results by Well Owner Name

1. (b) (6) [redacted] - { View PDF }
   Public Land Survey: SW, SW, S-17, T-19-N, R-28-E, Tax Parcel Number: 121126511
   County: Grant, Well Address: (b) (6) [redacted] Moses Lake 98837
   Well Log ID: 895216, Well Tag ID:BHW023, Notice of Intent Number: W355451
   Well Diameter: 6 in. , Well Depth: 180 ft.
   Well Type: Water
   Well Completion Date: 10/31/2013, Well Log Received Date: 12/11/2013
2. (b) (6) [redacted] - { View PDF }
   Public Land Survey: NW, SW, S-08, T-19-N, R-28-E, Tax Parcel Number: 120664102
   County: Grant, Well Address: (b) (6) [redacted] Moses Lake, WA 98837
   Well Log ID: 900474, Well Tag ID:BHW004, Notice of Intent Number: W362884
   Well Diameter: 6 in. , Well Depth: 260 ft.
   Well Type: Water
   Well Completion Date: 05/16/2013, Well Log Received Date: 06/04/2013
3. (b) (6) [redacted] - { View PDF }
   Public Land Survey: SW, NW, S-17, T-19-N, R-28-E, Tax Parcel Number: 121126406
   County: Grant, Well Address: (b) (6) [redacted]
   Well Log ID: 917026, Well Tag ID:BHW239, Notice of Intent Number: WE18064
   Well Diameter: 8 in. , Well Depth: 130 ft.
   Well Type: Water
   Well Completion Date: 05/02/2014, Well Log Received Date: 06/05/2014
4. (b) (6) [redacted] { View PDF }
   Public Land Survey: NW, NW, S-16, T-19-N, R-28-E, Tax Parcel Number: 12115000
   County: Grant, Well Address: (b) (6) [redacted]
   Well Log ID: 930299, Well Tag ID:BHW069, Notice of Intent Number: W355489
   Well Diameter: 6 in. , Well Depth: 120 ft.
   Well Type: Water
   Well Completion Date: 09/26/2014, Well Log Received Date: 10/14/2014
5. (b) (6) [redacted] - { View PDF }
   Public Land Survey: SE, SE, S-17, T-19-N, R-28-E, Tax Parcel Number: 170634000
   County: Grant, Well Address: (b) (6) [redacted]
   Well Log ID: 930365, Well Tag ID:BHW068, Notice of Intent Number: W355463
   Well Diameter: 6 in. , Well Depth: 180 ft.
   Well Type: Water
   Well Completion Date: 09/25/2014, Well Log Received Date: 10/14/2014
6. (b) (6) [redacted] - { View PDF }
   Public Land Survey: NE, SW, S-08, T-19-N, R-28-E, Tax Parcel Number: 120583301
   County: Grant, Well Address: (b) (6) [redacted]
   Well Log ID: 917084, Well Tag ID:BHW044, Notice of Intent Number: W355467
   Well Diameter: 6 in. , Well Depth: 240 ft.
   Well Type: Water
   Well Completion Date: 04/24/2014, Well Log Received Date: 05/30/2014
7. (b) (6) [redacted] - { View PDF }
   Public Land Survey: SW, NE, S-17, T-19-N, R-28-E, Tax Parcel Number: 121126351
   County: Grant, Well Address: (b) (6) [redacted] Moses Lake
   Well Log ID: 890106, Well Tag ID:BHP611, Notice of Intent Number: W362852
   Well Diameter: 6 in. , Well Depth: 115 ft.
   Well Type: Water
   Well Completion Date: 02/08/2013, Well Log Received Date: 04/29/2013
8. **Valley Estates Moses Lake LLC** (b) (6) [redacted] { View PDF }
   Public Land Survey: NW, NW, S-08, T-19-N, R-28-E, Tax Parcel Number: 120664108
   County: Grant, Well Address: 4766 NE Carol Drive, Moses Lake
   Well Log ID: 902215, Well Tag ID:BHW172, Notice of Intent Number: W350154
   Well Diameter: 6 in. , Well Depth: 276 ft.
   Well Type: Water
   Well Completion Date: 02/26/2014, Well Log Received Date: 03/20/2014

Total Result Pages: 1

Ecology Home | Report a Problem | Data Disclaimer | Privacy Policy

Well Logs

Home Map Search Text Search Forms Site Info Contact Us Water Portal

TEXT SEARCH RESULTS

Back New Search

- **Search Criteria Used:** Township: 20N, Range: 28E, Section(s): 16 17 19 20 21 22 27 28 29 30 31 32 33 34, Completed From: 01/01/2013, Completed To: 12/15/2014, Received From: 01/01/2013, Received To: 12/15/2014
- There are 23 well logs that match your search criteria.
- The results are sorted by Well Owner Name

Download all 23 images | Download all 23 data records | Print this page | Help

Displaying 1 - 20 of 23 well log results Sort results by Well Owner Name

1. **Grant County International Airport** - { View PDF }
Public Land Survey: NW, NW, S-33, T-20-N, R-28-E, Tax Parcel Number: (blank)
County: Grant, Well Address: 7810 Andrews Street NE #200
Well Log ID: 902946, Well Tag ID: , Notice of Intent Number: SE50613
Well Diameter: 8.5 in. , Well Depth: 5 ft.
Well Type: Resource Protection
Well Completion Date: 02/22/2014, Well Log Received Date: 03/21/2014

2. **Grant County International Airport** - { View PDF }
Public Land Survey: NW, NW, S-33, T-20-N, R-28-E, Tax Parcel Number: (blank)
County: Grant, Well Address: 7810 Andrews Street NE #200
Well Log ID: 902975, Well Tag ID: , Notice of Intent Number: SE50613
Well Diameter: 8.5 in. , Well Depth: 12 ft.
Well Type: Resource Protection
Well Completion Date: 02/22/2014, Well Log Received Date: 03/21/2014

3. **Grant County International Airport** - { View PDF }
Public Land Survey: NW, NW, S-33, T-20-N, R-28-E, Tax Parcel Number: (blank)
County: Grant, Well Address: 7810 Andrews Street NE #200
Well Log ID: 902976, Well Tag ID: , Notice of Intent Number: SE50613
Well Diameter: 8.5 in. , Well Depth: 20 ft.
Well Type: Resource Protection
Well Completion Date: 02/22/2014, Well Log Received Date: 03/21/2014

4. **Grant County International Airport** - { View PDF }
Public Land Survey: NW, NW, S-33, T-20-N, R-28-E, Tax Parcel Number: (blank)
County: Grant, Well Address: 7810 Andrews Street NE #200
Well Log ID: 902977, Well Tag ID: , Notice of Intent Number: SE50613
Well Diameter: 8.5 in. , Well Depth: 3 ft. 6 in.
Well Type: Resource Protection
Well Completion Date: 02/22/2014, Well Log Received Date: 03/21/2014

5. **Grant County International Airport** - { View PDF }
Public Land Survey: NW, NW, S-33, T-20-N, R-28-E, Tax Parcel Number: (blank)
County: Grant, Well Address: 7810 Andrews Street NE #200
Well Log ID: 910230, Well Tag ID: , Notice of Intent Number: AE25632
Well Diameter: 8.5 in. , Well Depth: 12 ft.
Well Type: Decommissioned
Well Completion Date: 02/22/2014, Well Log Received Date: 03/21/2014

6. **Grant County International Airport** - { View PDF }
Public Land Survey: NW, NW, S-33, T-20-N, R-28-E, Tax Parcel Number: (blank)
County: Grant, Well Address: 7810 Andrews Street NE #200
Well Log ID: 910231, Well Tag ID: , Notice of Intent Number: AE25632
Well Diameter: 8.5 in. , Well Depth: 3 ft. 6 in.
Well Type: Decommissioned
Well Completion Date: 02/22/2014, Well Log Received Date: 03/21/2014

7. **Grant County International Airport** - { View PDF }
Public Land Survey: NW, NW, S-33, T-20-N, R-28-E, Tax Parcel Number: (blank)
County: Grant, Well Address: 7810 Andrews Street NE #200
Well Log ID: 910246, Well Tag ID: , Notice of Intent Number: AE25632
Well Diameter: 8.5 in. , Well Depth: 5 ft.
Well Type: Decommissioned
Well Completion Date: 02/22/2014, Well Log Received Date: 03/21/2014

8. **Grant County International Airport** - { View PDF }
Public Land Survey: NW, NW, S-33, T-20-N, R-28-E, Tax Parcel Number: (blank)
County: Grant, Well Address: 7810 Andrews Street NE #200
Well Log ID: 910247, Well Tag ID: , Notice of Intent Number: AE25632
Well Diameter: 8.5 in. , Well Depth: 20 ft.
Well Type: Decommissioned
Well Completion Date: 02/22/2014, Well Log Received Date: 03/21/2014

9. **Grant County Port District 10** - { View PDF }
Public Land Survey: SW, NE, S-32, T-20-N, R-28-E, Tax Parcel Number: 171049016

County: Grant, Well Address: 6500 32nd Ave
Well Log ID: 930053, Well Tag ID: , Notice of Intent Number: SE52699
Well Diameter: 6 in. , Well Depth: 40 ft.
Well Type: Resource Protection
Well Completion Date: 09/22/2014, Well Log Received Date: 10/17/2014

10. **Grant County Port District 10** - { View PDF }
Public Land Survey: SW, NE, S-32, T-20-N, R-28-E, Tax Parcel Number: 171049016
County: Grant, Well Address: 6500 32nd Ave
Well Log ID: 930077, Well Tag ID: , Notice of Intent Number: AE28825
Well Diameter: 6 in. , Well Depth: 40 ft.
Well Type: Decommissioned
Well Completion Date: 09/22/2014, Well Log Received Date: 10/17/2014

11. **Old Larsen Air Force Base** - { View PDF }
Public Land Survey: NW, NW, S-33, T-20-N, R-28-E, Tax Parcel Number: (blank)
County: Grant, Well Address: 7988 Andrews St NE
Well Log ID: 914871, Well Tag ID: , Notice of Intent Number: SE51004
Well Diameter: 8.25 in. , Well Depth: 21 ft.
Well Type: Resource Protection
Well Completion Date: 04/08/2014, Well Log Received Date: 04/30/2014

12. **Old Larsen Air Force Base** - { View PDF }
Public Land Survey: NW, NW, S-33, T-20-N, R-28-E, Tax Parcel Number: (blank)
County: Grant, Well Address: 7988 Andrews St NE
Well Log ID: 914872, Well Tag ID: , Notice of Intent Number: SE51004
Well Diameter: 8.25 in. , Well Depth: 11 ft.
Well Type: Resource Protection
Well Completion Date: 04/08/2014, Well Log Received Date: 04/03/2014

13. **Old Larsen Air Force Base** - { View PDF }
Public Land Survey: NW, NW, S-33, T-20-N, R-28-E, Tax Parcel Number: (blank)
County: Grant, Well Address: 7988 Andrews St NE
Well Log ID: 914873, Well Tag ID: , Notice of Intent Number: AE26192
Well Diameter: 8.25 in. , Well Depth: 11 ft.
Well Type: Decommissioned
Well Completion Date: 04/08/2014, Well Log Received Date: 04/30/2014

14. **Old Larsen Air Force Base** - { View PDF }
Public Land Survey: NW, NW, S-33, T-20-N, R-28-E, Tax Parcel Number: (blank)
County: Grant, Well Address: 7988 Andrews St NE
Well Log ID: 914874, Well Tag ID: , Notice of Intent Number: AE26192
Well Diameter: 8.25 in. , Well Depth: 20 ft.
Well Type: Decommissioned
Well Completion Date: 04/08/2014, Well Log Received Date: 04/30/2014

15. **Old Larsen Air Force Base** - { View PDF }
Public Land Survey: NW, NW, S-33, T-20-N, R-28-E, Tax Parcel Number: (blank)
County: Grant, Well Address: 7988 Andrews St NE
Well Log ID: 914900, Well Tag ID: , Notice of Intent Number: SE51004
Well Diameter: 8.25 in. , Well Depth: 11 ft.
Well Type: Resource Protection
Well Completion Date: 04/08/2014, Well Log Received Date: 04/30/2014

16. **Old Larsen Air Force Base** - { View PDF }
Public Land Survey: NW, NW, S-33, T-20-N, R-28-E, Tax Parcel Number: (blank)
County: Grant, Well Address: 7988 Andrews St NE
Well Log ID: 914901, Well Tag ID: , Notice of Intent Number: SE51004
Well Diameter: 8.25 in. , Well Depth: 11 ft.
Well Type: Resource Protection
Well Completion Date: 04/08/2014, Well Log Received Date: 04/30/2014

17. **Old Larsen Air Force Base** - { View PDF }
Public Land Survey: NW, NW, S-33, T-20-N, R-28-E, Tax Parcel Number: (blank)
County: Grant, Well Address: 7988 Andrews St NE
Well Log ID: 914902, Well Tag ID: , Notice of Intent Number: SE51004
Well Diameter: 8.25 in. , Well Depth: 20 ft.
Well Type: Resource Protection
Well Completion Date: 04/08/2014, Well Log Received Date: 04/30/2014

18. **Old Larsen Air Force Base** - { View PDF }
Public Land Survey: NW, NW, S-33, T-20-N, R-28-E, Tax Parcel Number: (blank)
County: Grant, Well Address: 7988 Andrews St NE
Well Log ID: 914903, Well Tag ID: , Notice of Intent Number: AE26192
Well Diameter: 8.25 in. , Well Depth: 21 ft.
Well Type: Decommissioned
Well Completion Date: 04/08/2014, Well Log Received Date: 04/30/2014

19. **Old Larsen Air Force Base** - { View PDF }
Public Land Survey: NW, NW, S-33, T-20-N, R-28-E, Tax Parcel Number: (blank)
County: Grant, Well Address: 7988 Andrews St NE
Well Log ID: 914904, Well Tag ID: , Notice of Intent Number: AE26192
Well Diameter: 8.25 in. , Well Depth: 11 ft.
Well Type: Decommissioned
Well Completion Date: 04/08/2014, Well Log Received Date: 04/30/2014

20. **Old Larsen Air Force Base** - { View PDF }
Public Land Survey: NW, NW, S-33, T-20-N, R-28-E, Tax Parcel Number: (blank)
County: Grant, Well Address: 7988 Andrews St NE
Well Log ID: 914905, Well Tag ID: , Notice of Intent Number: AE26192

Well Diameter: 8.25 in. , Well Depth: 11 ft.
Well Type: Decommissioned
Well Completion Date: 04/08/2014, Well Log Received Date: 04/30/2014

1 2

Total Result Pages: 2

DEPARTMENT OF ECOLOGY State of Washington

Well Logs

Home Map Search Text Search Forms Site Info Contact Us Water Portal

TEXT SEARCH RESULTS

Back **New Search**

- **Search Criteria Used:** Township: 20N, Range: 28E, Section(s): 16 17 19 20 21 22 27 28 29 30 31 32 33 34, Completed From: 01/01/2013, Completed To: 12/15/2014, Received From: 01/01/2013, Received To: 12/15/2014
- There are 23 well logs that match your search criteria.
- The results are sorted by Well Owner Name

Download all 23 images | Download all 23 data records | Print this page | Help

Displaying 21 - 23 of 23 well log results Sort results by Well Owner Name

21. **Phillips 66** - { View PDF }
Public Land Survey: NE, NE, S-34, T-20-N, R-28-E, Tax Parcel Number: 190350000
County: Grant, Well Address: 3912 Rd 7.8 NE
Well Log ID: 889975, Well Tag ID:(blank), Notice of Intent Number: A089058
Well Diameter: 6 in. , Well Depth: 225 ft.
Well Type: Decommissioned
Well Completion Date: 02/13/2013, Well Log Received Date: 08/29/2013

22. (b) (6) [redacted] - { View PDF }
Public Land Survey: SE, NE, S-32, T-20-N, R-28-E, Tax Parcel Number: 122051000
County: Grant, Well Address: (b) (6) [redacted]
Well Log ID: 930072, Well Tag ID: , Notice of Intent Number: AE28826
Well Diameter: 6 in. , Well Depth: 40 ft.
Well Type: Decommissioned
Well Completion Date: 09/22/2014, Well Log Received Date: 10/17/2014

23. (b) (6) [redacted] { View PDF }
Public Land Survey: SE, NE, S-32, T-20-N, R-28-E, Tax Parcel Number: 122051000
County: Grant, Well Address (b) (6) [redacted]
Well Log ID: 930075, Well Tag ID: , Notice of Intent Number: SE52700
Well Diameter: 6 in. , Well Depth: 40 ft.
Well Type: Resource Protection
Well Completion Date: 09/22/2014, Well Log Received Date: 10/17/2014

1 **2**

Total Result Pages: 2

Ecology Home | Report a Problem | Data Disclaimer | Privacy Policy

The Department of Ecology does NOT Warranty the Data and/or the Information on this Well Report.

DEPARTMENT OF ECOLOGY
State of Washington

RECEIVED
FEB 18 2014

WATER WELL REPORT

503745

RECEIVED
DEC 11 2013
Department of Ecology
Eastern Regional Office

Notice of Intent Number W355451

Property Owner Last Name (b) (6) [redacted] First Name (b) (6) [redacted]

Organization Name

Department of Ecology
Eastern Regional Office

Well Tag ID Number (e.g., AAA-001) BHW-023 Variance Granted? (Circle One) Yes No

Water Right Permit Required? (Circle One) Yes or No If Yes, enter Water Right Permit Here (Required) ____

Well Use (Circle All That Apply):
Agricultural Irrigation, Domestic, Individual Irrigation, Parks and recreation, Test Well, Other ____
Commercial, Group Domestic, Municipal, Stockwater

Type of Work (Circle One):
Alteration, Hydrofracturing, Replacement, Other ____
Deepened Well, New

Method (Circle One):
Cable, Dug, Jetted, Other ____
Driven, Hydrofracturing, Rotary

Drilling Start Date ~~10/30/13~~ 10/31/13 Drilling Completion Date 10/31/13

Well Location Only (No Mailing Address, No PO Box, Cross Streets are ok)

Well Street Address (b) (6) [redacted]

Well City Moses Lak Well County Grant Well Zip Code 98837

Tax Parcel Number 12-1126-511

If claiming tax parcel exemption (Circle One) Tribal Federal Property Right of Way Railroad Land

NW	NE	NW	NE
SW	SE	SW	SE
NW	NE	NW	NE
X	SE	SW	SE

Place an "X" in ¼, ¼

Township 19 N Range 28 Circle One East or West Section 17

Latitude ____ Decimal Degrees; Longitude ____ West Decimal Degrees

CONSTRUCTION INFORMATION – SECURELY ATTACH (STAPLE) ADDITIONAL SHEETS OF INFORMATION (NO DRAWINGS) AS NEEDED.

Diameter of Well ____ ft 6 in, Drilled 180 ft ____ in Depth of Completed Well 180 ft ____ in

Casings (At least one Casing must have 6 in of stickup and all fields must be filled out for each casing entered)

Type (Circle One) Concrete Plastic Steel Other ____ Diameter 6 inches Stickup 24 inches Depth ~~180~~ ft +24 in, TO 168 ft ____ in

Type (Circle One) Concrete Plastic Steel Other ____ Diameter ____ inches Stickup ____ inches Depth ____ ft ____ in, TO ____ ft ____ in

Liners? Circle One Yes No (If yes, then complete the below fields that apply)

Type 1 (Circle One) PVC Steel Other ____ Diameter ____ in, From ____ ft ____ in TO ____ ft ____ in

Type 2 (Circle One) PVC Steel Other ____ Diameter ____ in, From ____ ft ____ in TO ____ ft ____ in

Perforations? Circle One Yes No (If yes, then complete the below fields that apply)

Type of Perforator (Circle One) Drill Mills Knife Saw cut Star Torch Cut Other ____ Perforation size ____ in by ____ in Total Perforations ____

Perforation 1 from ____ ft ____ in, TO ____ ft ____ inches Perforation 2 from ____ ft ____ in, TO ____ ft ____ inches

Screens? (Circle One) Yes No (If yes, then complete the below fields that apply)

Mfr 1 ____ Type ____ Diam ____ in Slot Size ____ From ____ ft ____ in TO ____ ft ____ in

Mfr 2 ____ Type ____ Diam ____ in Slot Size ____ From ____ ft ____ in TO ____ ft ____ in

503745

Sand/Gravel Packing? (Circle One) Yes No (If yes, then complete the below fields that apply)

Packing Material 1 Circle One 10-20 20-40 8-12 Coarse Sand Pea Gravel From____ft____in TO____ft____in
Packing Material 2 Circle One 10-20 20-40 8-12 Coarse Sand Pea Gravel From____ft____in TO____ft____in

Surface Seal Was there an existing surface seal? Yes or No Depth of Seal 18 ft ____in
Type of Seal Material (Circle One) Bentonite Bentonite Slurry Concrete Dry Bentonite Neat Cement Neat Cement Grout

Pump Pump Installed? (Circle One) Yes No If yes; Mfr Name____ Pump Type____ HP____

Static Water Level (Circle One and fill in the blanks if needed)

Yes ____ Measured Level (Below top of well)____ft____in Date Measured____
Flowing Artesian (Circle One) Greater Than or Equal To ____GPM____PSI Artesian Water Controlled by (e.g. Cap, Valve, etc.)____
Dry Hole
Unusable Water Strata? (Circle One) Yes No If Yes is circled, method of sealing strata off____
Strata 1 (Specify Unusable Water Type)____ From____ft____in TO____ft____in
Strata 2 (Specify Unusable Water Type)____ From____ft____in TO____ft____in

General Well Tests (Circle all that apply and fill in the blanks)
Bailer Test Date of test____ (Circle One) Greater Than or Equal To ____GPM, with____ Drawdown after____hrs____min
Air Test Date of test 10/31 (Circle One) Greater Than or Equal To 15 GPM, with stem set at 178 ft____in
Test Duration 1 hrs 30 min
Pump Test Date of test____ Test performed by____
Note: Drawdown=the amount the water level is lowered below the static level
Yield____gpm, with____ft____in; Drawdown after____hrs____min Yield____gpm, with____ft____in; Drawdown after____hrs____min
Yield____gpm, with____ft____in; Drawdown after____hrs____min Yield____gpm, with____ft____in; Drawdown after____hrs____min
Yield____gpm, with____ft____in; Drawdown after____hrs____min Yield____gpm, with____ft____in; Drawdown after____hrs____min
Note: Recovery=The time taken at zero when the pump is turned off. Water level is measured from the well top to...Ask Lars for wording
Time____hrs____min; Water Level____ft____in Time____hrs____min; Water Level____ft____in Time____hrs____min; Water Level____ft____in
Time____hrs____min; Water Level____ft____in Time____hrs____min; Water Level____ft____in Time____hrs____min; Water Level____ft____in
Time____hrs____min; Water Level____ft____in Time____hrs____min; Water Level____ft____in Time____hrs____min; Water Level____ft____in

Well Lithology Details – Your lithology MUST be reported to the drilled depth of the well. Please check your "From" and "To" feet and inches for accuracy.

Layer Formation Description	From	To	Layer Formation Description	From	To
Top Soil	0	2'			
Gravel gray Water Bearing	2	63'			
Brown clay No water	63	108'			
Soft Brown Broken BasalT Water Bearing	108'	145'			
Black hard BasalT no Water	145'	180'			

Comments – Enter any other important well construction and/or location details here.____

CERTIFICATION – I hereby certify that I constructed and/or accept responsibility for construction of this well, and its compliance with all Washington Well construction standards. Materials used and the information reported within the Well Report are true to my best knowledge and belief.

(Circle One) Driller Trainee Engineer Name(Print) Cole Eilers
Driller/Engineer/Trainee Signature [signature]
Driller/Trainee/PE License No. 3165T

If TRAINEE, Mentor Driller License No. 1267
Mentor Driller Signature [signature]

Drilling Company D.C. Drilling
Address P.O.Box 1269
City, State, Zip Royal City WA 99357
Phone Number 509 750 0610
Email Address Coleeilers@yahoo.com

WP-178

DEPARTMENT OF ECOLOGY State of Washington

506915

WATER WELL REPORT

RECEIVED JUN 04 2013 DEPARTMENT OF ECOLOGY EASTERN REGIONAL OFFICE

Notice of Intent Number W362884

Property Owner Last Name (b) (6) [redacted] First Name (b) (6) [redacted]

Organization Name

Well Tag ID Number (e.g., AAA-001) BHW 004 Variance Granted? (Circle One) Yes No

Water Right Permit Required? (Circle One) Yes or No If Yes, enter Water Right Permit Here (Required)

Well Use (Circle All That Apply):	Type of Work (Circle One):	Method (Circle One):
Agricultural Irrigation, Commercial, Domestic, Group Domestic, Individual Irrigation, Municipal, Parks and recreation, Stockwater, Test Well, Other	Alteration, Deepened Well, Hydrofracturing, New, Replacement, Other	Cable, Driven, Dug, Hydrofracturing, Jetted, Rotary, Other

Drilling Start Date 5-15-2013 Drilling Completion Date 5-16-2013

Well Location Only (No Mailing Address; No PO Box, Cross Streets are ok)

Well Street Address (b) (6) [redacted]

Well City Moses Lake Well County Grant 13 Well Zip Code 98837

Tax Parcel Number 12-0664-102

If claiming tax parcel exemption (Circle One) Tribal Federal Property Right of Way Railroad Land

~~NW~~ X	NE	NW	NE
~~SW~~ X	SE	SW	SE
NW	NE	NW	NE
SW	SE	SW	SE

Place an "X" in ¼, ¼

Township 19 N Range 28 Circle One East or ~~West~~ Section 8

Lattitude Decimal Degrees; Longitude West Decimal Degrees

CONSTRUCTION INFORMATION – SECURELY ATTACH (STAPLE) ADDITIONAL SHEETS OF INFORMATION (NO DRAWINGS) AS NEEDED.

Diameter of Well ___ ft 6 in, Drilled ___ ft ___ in Depth of Completed Well ___ ft ___ in

Casings (At least one Casing must have 6 in of stickup and all fields must be filled out for each casing entered)

Type (Circle One) Concrete Plastic Steel Other ___ Diameter 6 inches Stickup 24 inches Depth 119 ft 6 in, TO ___ ft ___ in

Type (Circle One) Concrete Plastic Steel Other ___ Diameter ___ inches Stickup ___ inches Depth ___ ft ___ in, TO ___ ft ___ in

Liners? Circle One Yes No (If yes, then complete the below fields that apply)

Type 1 (Circle One) PVC Steel Other ___ Diameter 4 in, From -10 ft ___ in TO 260 ft ___ in

Type 2 (Circle One) PVC Steel Other ___ Diameter ___ in, From ___ ft ___ in TO ___ ft ___ in

Perforations? Circle One Yes No (If yes, then complete the below fields that apply)

Type of Perforator (Circle One) Drill Mills Knife Saw cut Star Torch Cut Other ___ Perforation size ___ in by ___ in Total Perforations ___

Perforation 1 from ___ ft ___ in, TO ___ ft ___ inches Perforation 2 from ___ ft ___ in, TO ___ ft ___ inches

Screens? (Circle One) Yes No (If yes, then complete the below fields that apply)

Mfr 1 ___ Type ___ Diam ___ in Slot Size ___ From ___ ft ___ in TO ___ ft ___ in

Mfr 2 ___ Type ___ Diam ___ in Slot Size ___ From ___ ft ___ in TO ___ ft ___ in

WP-178

506915

Sand/Gravel Packing? (Circle One) Yes **No** (If yes, then complete the below fields that apply)

Packing Material 1 Circle One 10-20 20-40 8-12 Coarse Sand Pea Gravel From____ft ____in TO ____ft ____in
Packing Material 2 Circle One 10-20 20-40 8-12 Coarse Sand Pea Gravel From____ft ____in TO ____ft ____in

Surface Seal Was there an existing surface seal? **Yes** or No Depth of Seal 18 ft ____in
Type of Seal Material (Circle One) Bentonite Bentonite Slurry Concrete **Dry Bentonite** Neat Cement Neat Cement Grout

Pump Pump Installed? (Circle One) Yes **No** If yes, Mfr Name____ Pump Type____ HP____

Static Water Level (Circle One and fill in the blanks if needed)

Yes Measured Level (Below top of well) 76 ft ____ in Date Measured 5-16-13
Flowing Artesian (Circle One) Greater Than or Equal To ____GPM ____PSI Artesian Water Controlled by (e.g. Cap, Valve, etc.)____
Dry Hole
Unusable Water Strata? (Circle One) Yes **No** If Yes is circled, method of sealing strata off____
Strata 1 (Specify Unusable Water Type)____ From____ft ____in TO____ft ____in
Strata 2 (Specify Unusable Water Type)____ From____ft ____in TO____ft ____in

General Well Tests (Circle all that apply and fill in the blanks)
Bailer Test Date of test____ (Circle One) Greater Than or Equal To ____GPM, with ____ Drawdown after____hrs ____min
Air Test Date of test 5-16-13 (Circle One) Greater Than or Equal To 50 GPM, with stem set at 250 ft ____in
Test Duration 2 hrs ____min
Pump Test Date of test____ Test performed by M.W.M.
Note: Drawdown=the amount the water level is lowered below the static level
Yield ____gpm, with ____ft ____in; Drawdown after____hrs ____min Yield ____gpm, with ____ft ____in; Drawdown after____hrs ____min
Yield ____gpm, with ____ft ____in; Drawdown after____hrs ____min Yield ____gpm, with ____ft ____in; Drawdown after____hrs ____min
Yield ____gpm, with ____ft ____in; Drawdown after____hrs ____min Yield ____gpm, with ____ft ____in; Drawdown after____hrs ____min
Note: Recovery=The time taken at zero when the pump is turned off. Water level is measured from the well top to...Ask Lars for wording
Time___hrs___min; Water Level___ft___in Time___hrs___min; Water Level___ft___in Time___hrs___min; Water Level___ft___in
Time___hrs___min; Water Level___ft___in Time___hrs___min; Water Level___ft___in Time___hrs___min; Water Level___ft___in
Time___hrs___min; Water Level___ft___in Time___hrs___min; Water Level___ft___in Time___hrs___min; Water Level___ft___in

Well Lithology Details – Your lithology MUST be reported to the drilled depth of the well. Please check your "From" and "To" feet and inches for accuracy.

Layer Formation Description	From	To	Layer Formation Description	From	To
Top Soil	0	1	Gray Basalt	152	212
Soil & Gravel	1	3	Black Basalt with Blue	212	
Gravel & Sand	3	27	Flakes		224
Course Black Sand	27	41	Black Basalt	224	254
Black Sand & Gravel	41	56	Brown Porous Basalt	254	
Brown Clay	56	84	& Water		260
Bluegray Clay	84	102			
Brown Clay	102	116			
Brown Clay & Brown Basalt	116	119			
Brown Basalt & Water	119	129			
Black Basalt	129	145			
Brown Basalt (caving)	145	152			

Comments – Enter any other important well construction and/or location details here.____

CERTIFICATION – I hereby certify that I constructed and/or accept responsibility for construction of this well, and its compliance with all Washington Well construction standards. Materials used and the information reported within the Well Report are true to my best knowledge and belief.

(Circle One) Driller Trainee Engineer Name(Print) Mitch Mathews
Driller/Engineer/Trainee Signature [signature]
Driller/Trainee/PE License No. 1267

Drilling Company Mathews Drilling Inc
Address 2317 Rd 10.2 NE
City, State, Zip Moses Lake WA. 98837
Phone Number 509 762 5663
Email Address Mathews drillig @ Yahoo.com

If TRAINEE, Mentor Driller License No.____
Mentor Driller Signature____

The Department of Ecology does NOT Warranty the Data and/or the Information on this Well Report

WATER WELL REPORT

Original & 1st copy – Ecology, 2nd copy – owner, 3rd copy – driller

DEPARTMENT OF ECOLOGY State of Washington

Construction/Decommission *("x" in circle)*

☒ Construction

☐ Decommission *ORIGINAL INSTALLATION Notice of Intent Number* ______

CURRENT

Notice of Intent No. WE 18064

Unique Ecology Well ID Tag No. BHW 239

Water Right Permit No. ______

Property Owner Name (b) (6) [redacted]

Well Street Address

City Moses lake County Grant - 13

Location SW1/4-1/4 NW1/4 Sec 17 Twn 19N R 28E EWM ☒ or WWM ☐

(s, t, r Still REQUIRED)

Lat/Long Lat Deg ____ Lat Min/Sec ____

Long Deg ____ Long Min/Sec ____

Tax Parcel No. (Required) 121126406

PROPOSED USE: ☒ Domestic ☐ Industrial ☐ Municipal ☐ DeWater ☐ Irrigation ☐ Test Well ☐ Other ______

TYPE OF WORK: Owner's number of well (if more than one) ______

☒ New well ☐ Reconditioned ☐ Deepened *Method:* ☐ Dug ☐ Bored ☐ Driven ☐ Cable ☒ Rotary ☐ Jetted

DIMENSIONS: Diameter of well 8 inches, drilled 130 ft.

Depth of completed well ft. 130

CONSTRUCTION DETAILS

Casing Installed: ☒ Welded 8 " Diam. from 0 ft. to 85 ft.

☐ Liner installed ____ " Diam. from ____ ft. to ____ ft.

☐ Threaded ____ " Diam. From ____ ft. to ____ ft.

Perforations: ☐ Yes ☐ No

Type of perforator used ______

SIZE of perfs ____ in. by ____ in. and no. of perfs ____ from ____ ft. to ____ ft.

Screens: ☐ Yes ☐ No ☐ K-Pac Location ______

Manufacturer's Name ______

Type ______ Model No. ______

Diam. ____ Slot size ____ from ____ ft. to ____ ft.

Diam. ____ Slot size ____ from ____ ft. to ____ ft.

Gravel/Filter packed: ☐ Yes ☐ No Size of gravel/sand ______

Materials placed from ____ ft. to ____ ft.

Surface Seal: ☒ Yes ☐ No To what depth? 20 ft.

Material used in seal Bentonite

Did any strata contain unusable water? ☐ Yes ☐ No

Type of water? ______ Depth of strata ______

Method of sealing strata off ______

PUMP: Manufacturer's Name ______

Type: ______ H.P. ______

WATER LEVELS: Land-surface elevation above mean sea level ____ ft.

Static level 15 ft. below top of well Date 5-2-2014

Artesian pressure ____ lbs. per square inch Date ______

Artesian water is controlled by ______ (cap, valve, etc.)

WELL TESTS: Drawdown is amount water level is lowered below static level

Was a pump test made? ☐ Yes ☐ No If yes, by whom? ______

Yield: ____ gal./min. with ____ ft. drawdown after ____ hrs.

Yield: ____ gal./min. with ____ ft. drawdown after ____ hrs.

Yield: ____ gal./min. with ____ ft. drawdown after ____ hrs.

Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

Time	Water Level	Time	Water Level	Time	Water Level

Date of test ______

Bailer test ____ gal./min. with ____ ft. drawdown after ____ hrs.

Airtest 30 gal./min. with stem set at 120 ft. for 1 hrs.

Artesian flow ____ g.p.m. Date ______

Temperature of water ____ Was a chemical analysis made? ☐ Yes ☐ No

CONSTRUCTION OR DECOMMISSION PROCEDURE

Formation: Describe by color, character, size of material and structure, and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of information. (USE ADDITIONAL SHEETS IF NECESSARY.)

MATERIAL	FROM	TO
Top soil	0	2
Boulders	2	10
Gravel	10	40
Brown Clay	40	80
Brown clay - Brown basalt	80	95
Brown broken basalt	95	130
water		
Depth of Completed		
Well 130'		

RECEIVED

JUN 05 2014

Department of Ecology
Eastern Regional Office

Start Date 4-29-14 Completed Date 5-2-2014

WELL CONSTRUCTION CERTIFICATION: I constructed and/or accept responsibility for construction of this well, and its compliance with all Washington well construction standards. Materials used and the information reported above are true to my best knowledge and belief.

☒ Driller ☐ Engineer ☐ Trainee Name (Print) Salvador Valenciano

Driller/Engineer/Trainee Signature Salvador ValencianoA

Driller or trainee License No. 2986

IF TRAINEE: Driller's License No: ______

Driller's Signature: Salvador V.A.

Drilling Company Bransen Drilling

Address 406 Broadway Suite F.

City, State, Zip Moses lake Wa. 98837

Contractor's Registration No. BRANSDL954N5 Date 5-26-14

ECY 050-1-20 (Rev 02/10) *If you need this document in an alternate format, please call the Water Resources Program at 360-407-6872. Persons with hearing loss can call 711 for Washington Relay Service. Persons with a speech disability can call 877-833-6341.*

DEPARTMENT OF ECOLOGY State of Washington

WATER WELL REPORT

Original & 1st copy – Ecology, 2nd copy – owner, 3rd copy – driller

Construction/Decommission ("x" in circle)
☒ Construction
☐ Decommission ORIGINAL INSTALLATION
Notice of Intent Number ______

CURRENT
Notice of Intent No. W355489
Unique Ecology Well ID Tag No. BHW069
Water Right Permit No. NO
Property Owner Name (b) (6) [redacted]
Well Street Address [redacted]
City Mososlake County Grant
Location NW 1/4-1/4 NW 1/4 Sec 16 Twn 19 R 28 EWM ☒ Or WWM ☐
(s, t, r Still REQUIRED)

Lat/Long Lat Deg ____ Lat Min/Sec ____
Long Deg ____ Long Min/Sec ____
Tax Parcel No. (Required) 121115000

PROPOSED USE: ☒ Domestic ☐ Industrial ☐ Municipal ☐ DeWater ☐ Irrigation ☐ Test Well ☐ Other ______

TYPE OF WORK: Owner's number of well (if more than one) ______
☒ New well ☐ Reconditioned Method: ☐ Dug ☐ Bored ☐ Driven
☐ Deepened ☐ Cable ☒ Rotary ☐ Jetted

DIMENSIONS: Diameter of well 6 inches, drilled 120 ft.
Depth of completed well 120 ft.

CONSTRUCTION DETAILS
Casing Installed: ☒ Welded 6" Diam. from +2 ft. to 90 ft.
☐ Liner installed ____" Diam. from ____ ft. to ____ ft.
☐ Threaded ____" Diam. From ____ ft. to ____ ft.

Perforations: ☐ Yes ☒ No
Type of perforator used ______
SIZE of perfs ____ in. by ____ in. and no. of perfs ____ from ____ ft. to ____ ft.

Screens: ☐ Yes ☒ No ☐ K-Pac Location ______
Manufacturer's Name ______
Type ______ Model No. ______
Diam. ____ Slot size ____ from ____ ft. to ____ ft.
Diam. ____ Slot size ____ from ____ ft. to ____ ft.

Gravel/Filter packed: ☐ Yes ☒ No Size of gravel/sand ______
Materials placed from ____ ft. to ____ ft.

Surface Seal: ☒ Yes ☐ No To what depth? 18 ft.
Material used in seal Dry Bentonite
Did any strata contain unusable water? ☒ Yes ☐ No
Type of water? Surface Depth of strata 34'
Method of sealing strata off Cased Off

PUMP: Manufacturer's Name ______
Type: ______ H.P. ______

WATER LEVELS: Land-surface elevation above mean sea level ____ ft.
Static level 36 ft. below top of well Date 9/26/14
Artesian pressure ____ lbs. per square inch Date ______
Artesian water is controlled by ______ (cap, valve, etc.)

WELL TESTS: Drawdown is amount water level is lowered below static level
Was a pump test made? ☐ Yes ☒ No If yes, by whom? ______
Yield: ____ gal./min. with ____ ft. drawdown after ____ hrs.
Yield: ____ gal./min. with ____ ft. drawdown after ____ hrs.
Yield: ____ gal./min. with ____ ft. drawdown after ____ hrs.

Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

Time	Water Level	Time	Water Level	Time	Water Level

Date of test ______
Bailer test ____ gal./min. with ____ ft. drawdown after ____ hrs.
Airtest 100 gal./min. with stem set at 118 ft. for 1.5 hrs.
Artesian flow ____ g.p.m. Date ______
Temperature of water ____ Was a chemical analysis made? ☐ Yes ☒ No

CONSTRUCTION OR DECOMMISSION PROCEDURE
Formation: Describe by color, character, size of material and structure, and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of information. (USE ADDITIONAL SHEETS IF NECESSARY.)

MATERIAL	FROM	TO
TopSoil	0'	2'
Gravel & Black Sand	2'	36'
Gravel & H_2O Some Sand	36'	59'
Brown Clay Gravel & H_2O	59'	72'
Brown Clay Dry	72'	76'
Dry Tan Clay	76'	88'
Brown Basalt & Tan Clay	88'	97'
Brown Basalt Broken Lots of H_2O	97'	120

RECEIVED
OCT 14 2014
Department of Ecology
Eastern Regional Office

Start Date 9/26/14 Completed Date 9/26/14

WELL CONSTRUCTION CERTIFICATION: I constructed and/or accept responsibility for construction of this well, and its compliance with all Washington well construction standards. Materials used and the information reported above are true to my best knowledge and belief.

☐ Driller ☐ Engineer ☒ Trainee Name (Print) Cole
Driller/Engineer/Trainee Signature [signature]
Driller or trainee License No. 3165T
IF TRAINEE: Driller's License No: 1267
Driller's Signature: Mitch Martin

Drilling Company D.C Drilling Inc
Address PO Box 1269
City, State, Zip Royal City WA 99357
Contractor's Registration No. DCDRICD878OF Date 9/26/14

ECY 050-1-20 (Rev 02/10) *If you need this document in an alternate format, please call the Water Resources Program at 360-407-6872. Persons with hearing loss can call 711 for Washington Relay Service. Persons with a speech disability can call 877-833-6341.*

DEPARTMENT OF ECOLOGY State of Washington

WATER WELL REPORT

Original & 1st copy – Ecology, 2nd copy – owner, 3rd copy – driller

Construction/Decommission ("x" in circle)
[X] Construction
[ ] Decommission ORIGINAL INSTALLATION
Notice of Intent Number ______

CURRENT
Notice of Intent No. W355463
Unique Ecology Well ID Tag No. BHW 068
Water Right Permit No. NO
Property Owner Name (b) (6) [redacted]
Well Street Address [redacted]
City MosesLake County Grant
Location SE 1/4-1/4 SE 1/4 Sec 17 Twn 19 R 28 EWM [X] or WWM [ ]
(s, t, r Still REQUIRED)

Lat/Long Lat Deg ____ Lat Min/Sec ____
Long Deg ____ Long Min/Sec ____
Tax Parcel No. (Required) 170634000

PROPOSED USE: [X] Domestic [ ] Industrial [ ] Municipal [ ] DeWater [ ] Irrigation [ ] Test Well [ ] Other ______

TYPE OF WORK: Owner's number of well (if more than one) ______
[X] New well [ ] Reconditioned Method: [ ] Dug [ ] Bored [ ] Driven
[ ] Deepened [ ] Cable [X] Rotary [ ] Jetted

DIMENSIONS: Diameter of well 6 inches, drilled 180 ft.
Depth of completed well 180 ft.

CONSTRUCTION DETAILS
Casing Installed: [X] Welded 6" Diam. from +2 ft. to 93' ft.
[ ] Liner installed ____" Diam. from ____ ft. to ____ ft.
[ ] Threaded ____" Diam. From ____ ft. to ____ ft.

Perforations: [ ] Yes [X] No
Type of perforator used ______
SIZE of perfs ____ in. by ____ in. and no. of perfs ____ from ____ ft. to ____ ft.

Screens: [ ] Yes [X] No [ ] K-Pac Location ______
Manufacturer's Name ______
Type ______ Model No. ______
Diam. ____ Slot size ____ from ____ ft. to ____ ft.
Diam. ____ Slot size ____ from ____ ft. to ____ ft.

Gravel/Filter packed: [ ] Yes [X] No Size of gravel/sand ______
Materials placed from ____ ft. to ____ ft.

Surface Seal: [X] Yes [ ] No To what depth? 18 ft.
Material used in seal Dry Bentonite
Did any strata contain unusable water? [X] Yes [ ] No
Type of water? SurFace Depth of strata 46'
Method of sealing strata off Casing

PUMP: Manufacturer's Name ______
Type: ______ H.P. ______

WATER LEVELS: Land-surface elevation above mean sea level ____ ft.
Static level 24 ft. below top of well Date 9/25/14
Artesian pressure ____ lbs. per square inch Date ______
Artesian water is controlled by ______ (cap, valve, etc.)

WELL TESTS: Drawdown is amount water level is lowered below static level
Was a pump test made? [ ] Yes [X] No If yes, by whom? ______
Yield: ____ gal./min. with ____ ft. drawdown after ____ hrs.
Yield: ____ gal./min. with ____ ft. drawdown after ____ hrs.
Yield: ____ gal./min. with ____ ft. drawdown after ____ hrs.
Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

Time	Water Level	Time	Water Level	Time	Water Level

Date of test ______
Bailer test ____ gal./min. with ____ ft. drawdown after ____ hrs.
Airtest 15 gal./min. with stem set at ____ ft. for ____ hrs.
Artesian flow ____ g.p.m. Date ______
Temperature of water ____ Was a chemical analysis made? [ ] Yes [X] No

CONSTRUCTION OR DECOMMISSION PROCEDURE
Formation: Describe by color, character, size of material and structure, and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of information. (USE ADDITIONAL SHEETS IF NECESSARY.)

MATERIAL	FROM	TO
Topsoil	0'	2'
Gravel	2'	24'
Gravel & H_2O	24'	29'
Gravel Brown Clay & H_2O	29'	46'
Brown Clay No H_2O	46'	50'
Tan Clay	50'	91'
SoFT Brown Broken Basalt Little H_2O 5gpm	91'	104'
Hard Gray Basalt	104'	157'
SoFT Brown BaSalt & H_2O	157'	164'
Hard Gray Basalt	164'	180'

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OCT 14 2014
Department of Ecology
Eastern Regional Office

Start Date 9/25/14 Completed Date 9/25/14

WELL CONSTRUCTION CERTIFICATION: I constructed and/or accept responsibility for construction of this well, and its compliance with all Washington well construction standards. Materials used and the information reported above are true to my best knowledge and belief.

[ ] Driller [ ] Engineer [X] Trainee Name (Print) Cole
Driller/Engineer/Trainee Signature D. C. E.
Driller or trainee License No. 3165T
IF TRAINEE: Driller's License No: 1267
Driller's Signature: Mitch Martin

Drilling Company D.C Drilling Inc
Address PO Box 1289
City, State, Zip Royal City WA 99357
Contractor's Registration No. DCDRICD875OF Date 9/25/14

ECY 050-1-20 (Rev 02/10) *If you need this document in an alternate format, please call the Water Resources Program at 360-407-6872. Persons with hearing loss can call 711 for Washington Relay Service. Persons with a speech disability can call 877-833-6341.*

DEPARTMENT OF ECOLOGY
State of Washington

WATER WELL REPORT

RECEIVED
MAY 30 2014
Department of Ecology
Eastern Regional Office

Notice of Intent Number W355467

Property Owner Last Name (b) (6) [redacted] First Name (b) (6) [redacted]

Organization Name

Well Tag ID Number (e.g., AAA-001) BHW 044 Variance Granted? (Circle One) Yes No

Water Right Permit Required? (Circle One) Yes or No If Yes, enter Water Right Permit Here (Required)

Well Use (Circle All That Apply):	Type of Work (Circle One):	Method (Circle One):
Agricultural Irrigation, ~~Domestic~~, Individual Irrigation, Parks and recreation, Test Well, Other; Commercial, Group Domestic, Municipal, Stockwater	Alteration, Hydrofracturing, Replacement, Other; Deepened Well, New	Cable, Dug, Jetted, Other; Driven, Hydrofracturing, Rotary

Drilling Start Date 4-24-14 Drilling Completion Date 4-24-14

Well Location Only (No Mailing Address, No PO Box, Cross Streets, etc.)

Well Street Address (b) (6) [redacted]

Well City Moses Lake Well County Grant Well Zip Code

Tax Parcel Number 120583301

If claiming tax parcel exemption (Circle One) Tribal Federal Property Right of Way Railroad Land

NW	NE	NW	NE
SW	SE	SW	SE
NW	NE	NW	X
SW	SE	SW	SE

Place an "X" in ¼, ¼

Township 19 N Range 28 Circle One East or West Section 8

Lattitude Decimal Degrees; Longitude West Decimal Degrees

CONSTRUCTION INFORMATION – SECURELY ATTACH (STAPLE) ADDITIONAL SHEETS OF INFORMATION (NO DRAWINGS) AS NEEDED.

Diameter of Well ___ ft 6 in, Drilled 240 ft ___ in Depth of Completed Well 240 ft ___ in

Casings (At least one Casing must have 6 in of stickup and all fields must be filled out for each casing entered)

Type (Circle One) Concrete Plastic Steel Other ___ Diameter 6 inches Stickup +24 inches Depth +2 ft ___ in, TO 110 ft ___ in

Type (Circle One) Concrete Plastic Steel Other ___ Diameter ___ inches Stickup ___ inches Depth ___ ft ___ in, TO ___ ft ___ in

Liners? Circle One Yes No (If yes, then complete the below fields that apply)

Type 1 (Circle One) PVC Steel Other ___ Diameter ___ in, From ___ ft ___ in TO ___ ft ___ in

Type 2 (Circle One) PVC Steel Other ___ Diameter ___ in, From ___ ft ___ in TO ___ ft ___ in

Perforations? Circle One Yes No (If yes, then complete the below fields that apply)

Type of Perforator (Circle One) Drill Mills Knife Saw cut Star Torch Cut Other ___ Perforation size ___ in by ___ in Total Perforations ___

Perforation 1 from ___ ft ___ in, TO ___ ft ___ inches Perforation 2 from ___ ft ___ in, TO ___ ft ___ inches

Screens? (Circle One) Yes No (If yes, then complete the below fields that apply)

Mfr 1 ___ Type ___ Diam ___ in Slot Size ___ From ___ ft ___ in TO ___ ft ___ in

Mfr 2 ___ Type ___ Diam ___ in Slot Size ___ From ___ ft ___ in TO ___ ft ___ in

ECY 050-1-20 (Rev 2/11) The Department of Ecology does NOT warranty the Data and/or Information on this Well Report.
If you need this document in an alternate format for the visually impaired, please call the Water Resources Program at 360-407-6872. Persons with hearing loss can call 711 for Washington Relay Service. Persons with a speech disability can call 877-833-6341.

The Department of Ecology does NOT Warranty the Data and/or the Information on this Well Report

The Department of Ecology does NOT Warranty the Data and/or the Information on this Well Report

Sand/Gravel Packing? (Circle One) Yes **No** (If yes, then complete the below fields that apply)

Packing Material 1 Circle One 10-20 20-40 8-12 Coarse Sand Pea Gravel From____ft ____in TO ____ft ____in
Packing Material 2 Circle One 10-20 20-40 8-12 Coarse Sand Pea Gravel From____ft ____in TO ____ft ____in

Surface Seal Was there an existing surface seal? Yes or **No** Depth of Seal 18 ft ____in
Type of Seal Material (Circle One) Bentonite Bentonite Slurry Concrete **Dry Bentonite** Neat Cement Neat Cement Grout

Pump Pump Installed? (Circle One) Yes **No** If yes, Mfr Name____ Pump Type____ HP____

Static Water Level (Circle One and fill in the blanks if needed)

Yes Measured Level (Below top of well) 54 ft ____ in Date Measured 4/24/14
Flowing Artesian (Circle One) Greater Than or Equal To ____GPM ____PSI Artesian Water Controlled by (e.g. Cap, Valve, etc.)____
Dry Hole

Unusable Water Strata? (Circle One) **Yes** No If Yes is circled, method of sealing strata off Casing
Strata 1 (Specify Unusable Water Type) Surface water From ~~48~~39 ft ____in TO 67 ft ____in
Strata 2 (Specify Unusable Water Type)____ From____ft ____in TO____ft ____in

General Well Tests (Circle all that apply and fill in the blanks)

Bailer Test Date of test____ (Circle One) Greater Than or Equal To ____GPM, with ____ Drawdown after____hrs ____min
Air Test Date of test 4/24/14 (Circle One) Greater Than or Equal To 37 GPM, with stem set at 238 ft ____in
Test Duration 1 hrs 30 min
Pump Test Date of test____ Test performed by____

Note: Drawdown=the amount the water level is lowered below the static level

Yield ____gpm, with ____ft ____in; Drawdown after____hrs ____min Yield ____gpm, with ____ft ____in; Drawdown after____hrs ____min
Yield ____gpm, with ____ft ____in; Drawdown after____hrs ____min Yield ____gpm, with ____ft ____in; Drawdown after____hrs ____min
Yield ____gpm, with ____ft ____in; Drawdown after____hrs ____min Yield ____gpm, with ____ft ____in; Drawdown after____hrs ____min

Note: Recovery=The time taken at zero when the pump is turned off. Water level is measured from the well top to...Ask Lars for wording

Time____hrs____min; Water Level____ft____in Time____hrs____min; Water Level____ft____in Time____hrs____min; Water Level____ft____in
Time____hrs____min; Water Level____ft____in Time____hrs____min; Water Level____ft____in Time____hrs____min; Water Level____ft____in
Time____hrs____min; Water Level____ft____in Time____hrs____min; Water Level____ft____in Time____hrs____min; Water Level____ft____in

Well Lithology Details – Your lithology MUST be reported to the drilled depth of the well. Please check your "From" and "To" feet and inches for accuracy.

Layer Formation Description	From	To	Layer Formation Description	From	To
Top Soil	0	1'			
Cobbles & gravel	1'	12'			
Gravel	12'	39'			
gravel & H_2O	39'	64'			
Brown Clay	64'	103'			
Brown Broken Basalt & Clay Brown	103'	110'			
Brown Broken Basalt & H_2O	110'	147'			
Hard gray Basalt two H_2O	147'	232'			
Brown Broken Basalt & H_2O	232'	238'			
Hard Gray Basalt	238'	240'			

Comments – Enter any other important well construction and/or location details here.____

CERTIFICATION – I hereby certify that I constructed and/or accept responsibility for construction of this well, and its compliance with all Washington Well construction standards. Materials used and the information reported within the Well Report are true to my best knowledge and belief.

(Circle One) Driller Trainee Engineer Name(Print) Cole Drilling Company DC Drilling Inc
Driller/Engineer/Trainee Signature D Cagin Address P.O Box 1269
Driller/Trainee/PE License No. 3165 City, State, Zip Royal City WA 99357
If TRAINEE, Mentor Driller License No. 1267 Phone Number 509 790 2171
Mentor Driller Signature Mitch Marks Email Address____

The Department of Ecology does NOT Warranty the Data and/or the Information on this Well Report.

WATER WELL REPORT

Original & 1st copy – Ecology, 2nd copy – owner, 3rd copy – driller

ECOLOGY

Construction/Decommission ("x" in circle) 500426

☒ Construction

○ Decommission ORIGINAL INSTALLATION Notice of Intent Number W362852

CURRENT Notice of Intent No. W362852

Unique Ecology Well ID Tag No. BHP611

Water Right Permit No.

Property Owner Name (b) (6)

Well Street Address

City Moses Lake County Grant 13

Location SW 1/4-1/4 NE 1/4 Sec 17 Twn 19 R 28 (EWM) or WWM circle one

Lat/Long (s, t, r Still REQUIRED) Lat Deg ______ Lat Min/Sec ______ Long Deg ______ Long Min/Sec ______

Tax Parcel No. 12-1126-351

PROPOSED USE: ☒ Domestic ☐ Industrial ☐ Municipal ☐ DeWater ☐ Irrigation ☐ Test Well ☐ Other ______

TYPE OF WORK: Owner's number of well (if more than one) ______

☒ New well ☐ Reconditioned Method: ☐ Dug ☐ Bored ☐ Driven ☐ Deepened ☐ Cable ☒ Rotary ☐ Jetted

DIMENSIONS: Diameter of well 6 inches, drilled 115 ft. Depth of completed well 115 ft.

CONSTRUCTION DETAILS

Casing Installed: ☒ Welded 6" Diam. from +2 ft. to 78 ft.
☐ Liner installed ____" Diam. from ____ ft. to ____ ft.
☐ Threaded ____" Diam. from ____ ft. to ____ ft.

Perforations: ☐ Yes ☒ No

Type of perforator used ______

SIZE of perfs ____ in. by ____ in. and no. of perfs ____ from ____ ft. to ____ ft.

Screens: ☐ Yes ☒ No ☐ K-Pac Location ______

Manufacturer's Name ______

Type ______ Model No. ______

Diam. ____ Slot size ____ from ____ ft. to ____ ft.

Diam. ____ Slot size ____ from ____ ft. to ____ ft.

Gravel/Filter packed: ☐ Yes ☒ No ☐ Size of gravel/sand ______

Materials placed from ____ ft. to ____ ft.

Surface Seal: ☒ Yes ☐ No To what depth? 18 ft.

Material used in seal Bentonite

Did any strata contain unusable water? ☒ Yes ☐ No

Type of water? Surface Depth of strata 31-58

Method of sealing strata off Casing

PUMP: Manufacturer's Name ______

Type: ______ H.P. ______

WATER LEVELS: Land-surface elevation above mean sea level ____ ft.

Static level 26 ft. below top of well Date 2-8-13

Artesian pressure ____ lbs. per square inch Date ____

Artesian water is controlled by ______ (cap, valve, etc.)

WELL TESTS: Drawdown is amount water level is lowered below static level

Was a pump test made? ☐ Yes ☒ No If yes, by whom? ______

Yield: ____ gal./min. with ____ ft. drawdown after ____ hrs.

Yield: ____ gal./min. with ____ ft. drawdown after ____ hrs.

Yield: ____ gal./min. with ____ ft. drawdown after ____ hrs.

Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

Time	Water Level	Time	Water Level	Time	Water Level

Date of test ______

Bailer test ____ gal./min. with ____ ft. drawdown after ____ hrs.

Airtest 60 gal./min. with stem set at 160 ft. for 2 hrs.

Artesian flow ____ g.p.m. Date ____

Temperature of water ____ Was a chemical analysis made? ☐ Yes ☒ No

CONSTRUCTION OR DECOMMISSION PROCEDURE

Formation: Describe by color, character, size of material and structure, and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of information. (USE ADDITIONAL SHEETS IF NECESSARY.)

MATERIAL	FROM	TO
Top Soil	0	2
Soil & Gravel	2	5
gravel Small	5	24
Black Sand	24	31
Black Sand & Water	31	46
Gravel & Water	46	58
Brown Clay & Gravel	58	61
Light Brown Clay	61	74
Brown Clay	74	77
Brown Basalt & Clay	77	78
Black Basalt	78	103
Brown Porous Basalt & Water	103	115

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APR 29 2013

DEPARTMENT OF ECOLOGY EASTERN REGIONAL OFFICE

Start Date 2-8-13 Completed Date 2-8-13

WELL CONSTRUCTION CERTIFICATION: I constructed and/or accept responsibility for construction of this well, and its compliance with all Washington well construction standards. Materials used and the information reported above are true to my best knowledge and belief.

☒ Driller ☐ Engineer ☐ Trainee Name (Print) Mitch Mathews

Driller/Engineer/Trainee Signature Mitch Mathews

Driller or trainee License No. 1267

If TRAINEE, Driller's Licensed No. ______

Driller's Signature ______

Drilling Company Mathews Drilling Inc.

Address 2317 Rd 10.2 NE

City, State, Zip Moses Lake, WA 98837

Contractor's Registration No. MATHEDI934DA Date 2-8-2013

Ecology is an Equal Opportunity Employer.

ECY 050-1-20 (Rev 3/05) **The Department of Ecology does NOT warranty the Data and/or Information on this Well Report.**

The Department of Ecology does NOT Warranty the Data and/or the Information on this Well Report.

WATER WELL REPORT 507705

Original & 1st copy – Ecology, 2nd copy – owner, 3rd copy – driller

DEPARTMENT OF ECOLOGY State of Washington

Construction/Decommission *("x" in circle)*

☒ Construction

☐ Decommission *ORIGINAL INSTALLATION Notice of Intent Number* ______

CURRENT

Notice of Intent No. W350154

Unique Ecology Well ID Tag No. BHW 172

Water Right Permit No. ______

Property Owner Name Valley Estates Moses Lake LLC

Well Street Address 4266 Cua Dr

City Moses Lake County Grant

Location NE 1/4-1/4 NE 1/4 Sec 8 Twn 19 R 28 EWM ☐ Or WWM ☐

(s, t, r Still REQUIRED)

Lat/Long Lat Deg ____ Lat Min/Sec ____ Long Deg ____ Long Min/Sec ____

Tax Parcel No. (Required) 120664108

PROPOSED USE: ☒ Domestic ☐ Industrial ☐ Municipal ☐ DeWater ☐ Irrigation ☐ Test Well ☐ Other ______

TYPE OF WORK: Owner's number of well (if more than one) ______

☒ New well ☐ Reconditioned *Method:* ☐ Dug ☐ Bored ☐ Driven ☐ Deepened ☐ Cable ☒ Rotary ☐ Jetted

DIMENSIONS: Diameter of well 6 inches, drilled 276 ft. Depth of completed well 276 ft.

CONSTRUCTION DETAILS

Casing Installed: ☒ Welded 6" Diam. from +2 ft. to 133 ft.
☐ Liner installed ____" Diam. from ____ ft. to ____ ft.
☐ Threaded ____" Diam. From ____ ft. to ____ ft.

Perforations: ☐ Yes ☒ No

Type of perforator used ______

SIZE of perfs ____ in. by ____ in. and no. of perfs ____ from ____ ft. to ____ ft.

Screens: ☐ Yes ☒ No ☐ K-Pac Location ______

Manufacturer's Name ______

Type ______ Model No. ______

Diam. ____ Slot size ____ from ____ ft. to ____ ft.

Diam. ____ Slot size ____ from ____ ft. to ____ ft.

Gravel/Filter packed: ☐ Yes ☒ No Size of gravel/sand ______

Materials placed from ____ ft. to ____ ft.

Surface Seal: ☒ Yes ☐ No To what depth? 18 ft.

Material used in seal Bentonite

Did any strata contain unusable water? ☐ Yes ☒ No

Type of water? ______ Depth of strata ______

Method of sealing strata off ______

PUMP: Manufacturer's Name ______

Type: ______ H.P. ______

WATER LEVELS: Land-surface elevation above mean sea level 0 ft.

Static level 90 ft. below top of well Date 2-26-14

Artesian pressure ____ lbs. per square inch Date ______

Artesian water is controlled by ______ (cap, valve, etc.)

WELL TESTS: Drawdown is amount water level is lowered below static level

Was a pump test made? ☐ Yes ☐ No If yes, by whom? ______

Yield: ____ gal./min. with ____ ft. drawdown after ____ hrs.

Yield: ____ gal./min. with ____ ft. drawdown after ____ hrs.

Yield: ____ gal./min. with ____ ft. drawdown after ____ hrs.

Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

Time	Water Level	Time	Water Level	Time	Water Level

Date of test ______

Bailer test ____ gal./min. with ____ ft. drawdown after ____ hrs.

Airtest 25 gal./min. with stem set at 276 ft. for 1 hrs.

Artesian flow ____ g.p.m. Date ______

Temperature of water ____ Was a chemical analysis made? ☐ Yes ☒ No

CONSTRUCTION OR DECOMMISSION PROCEDURE

Formation: Describe by color, character, size of material and structure, and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of information. (USE ADDITIONAL SHEETS IF NECESSARY.)

MATERIAL	FROM	TO
Dirt	0	1
Dirt/Cobble	1	16
Gravel	16	60
Clay	60	72
Clay/Silt	72	110
Sandstone	110	131
Broken Basalt	131	133
Black Basalt	133	210
Brown Basalt	210	225
Black Basalt	225	265
(WB) Broken Basalt	265	276

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Start Date 2-24-14 Completed Date 2-26-14

WELL CONSTRUCTION CERTIFICATION: I constructed and/or accept responsibility for construction of this well, and its compliance with all Washington well construction standards. Materials used and the information reported above are true to my best knowledge and belief.

☒ Driller ☐ Engineer ☐ Trainee Name (Print) Kevin Boyd

Driller/Engineer/Trainee Signature [signature]

Driller or trainee License No. 2956

IF TRAINEE: Driller's License No: ______

Driller's Signature: ______

Drilling Company Empire Well Drilling LLC

Address 1447 Rd 8 N.E.

City, State, Zip Moses Lake, WA. 98837

Contractor's Registration No. EmpirWD876MN Date 2/26/14

ECY 050-1-20 (Rev 02/10) *If you need this document in an alternate format, please call the Water Resources Program at 360-407-6872. Persons with hearing loss can call 711 for Washington Relay Service. Persons with a speech disability can call 877-833-6341.*

APPENDIX I – Well Logs (CD only)